A SPATIOTEMPORAL ANALYSIS OF THE MCKEAN COMPLEX ON THE NORTHERN PLAINS

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By Yvonne Fortin

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Abstract

Characterizing hunter-gatherer mobility has been problematic in archaeological research (Anthony 1990). For pre-contact cultures on the Northern Plains there is no documentation of the human decisions involved in movement processes. This thesis examines the known information available regarding the McKean Complex on the Northern Plains. Using radiocarbon ages and known site locations, Kriging analysis was used to create a predictive model to examine spread of this archaeological complex, directions of movement, and origins. This thesis re-examines existing theories regarding origin and migration with regards to this model. The geographic distribution of projectile point styles, floral remains and faunal remains are also examined. This research provides a comprehensive database of stratified sites with McKean components as well as a comprehensive database of McKean radiocarbon ages associated with McKean projectile points. This study offers new information regarding subsistence and expansion of the complex, providing a preliminary model towards re-examining the McKean Complex. The model will benefit from future research with regards to the McKean Complex as more radiocarbon ages taken from McKean sites can only help improve the current model and help provide a greater understanding of this cultural group on the Northern Plains.

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To my husband James, I wouldn't have been able to finish this thesis without you. Thank you for your unwavering support and genuine interest in my research.

Dedication

This thesis is dedicated to James and Olive. I am so grateful to know you both and have you in my life. I love you guys.

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Chapter 1: Introduction

1.1 Introduction

Characterizing hunter-gatherer mobility has been problematic in archaeological research (Anthony 1990:895). For pre-contact cultures there is no documentation of the human decisions involved in movement processes. From archaeological evidence we have determined that many pre-contact cultural groups on the Northern Plains were mobile and reliant on bison (Dyck 1983; Kornfeld et al. 2010; Peck 2011; Walker 1992; Wettlaufer 1955; Wright 1995). However, due to high levels of pre-contact mobility, the archaeological evidence is mainly limited to short-term campsites with sparse amounts of stone tools, projectile points, and plant and faunal remains. Archaeologists attempt to use these data to determine who these people were and connect these groups to one another across the vast landscape of the Northern Plains.

New digital technologies have led to new analytical methods for large data sets, the refinement of older methods, as well as the reinterpretation of old data. The utilization of GIS software has become instrumental in the interpretation and understanding of past cultures (Boaz and Uleberg 2000:101-115; Bove 1981:93-112; Harris 2000:116-123; Kornfeld et al. 2010:330-335; Kvamme 1990:197-207; Llobera 1999:65-84). The research presented in this thesis will demonstrate the utility of these technologies by utilizing data from a range of sources to create a Geographical Information Systems (GIS) database that will be utilized to re-examine theories regarding hunter-gatherer mobility and origins of the McKean Complex on the Northern Plains.

The archaeological evidence indicates that the people of the McKean Complex were highly adaptable, mobile bison hunters (Kornfeld et al. 2010:113-122; Peck 2011:223; Wright 1995:302-307). There are several theories regarding the origin and the hypothesized movement of this complex. Webster (2004:82-86) and Morlan (1993:3-84) suggest that the people represented by the McKean Complex are a migratory population with possible origins in either the Great Basin area or in the Rocky Mountains. Evidence of this movement includes consistency in projectile point style in relation to site variability. Wright (1995:302) argues that there was an evolutionary relationship between the preceding Oxbow and McKean Complexes, with Oxbow transitioning into McKean. Conversely, many (Brumley 1975; Jennings 1964:153; Wedel 1961:254-255) have hypothesized that the McKean Complex was a regional variant of the Desert Culture adaptation. Husted (1969:65-67), Syms (1970:131), Keyser and Davis (1984:54-

55), and Benedict and Olson (1973:323-327) argue that the McKean Complex originated in the Rocky Mountains evolving from Plano cultures and the bearers of this cultural assemblage moved onto the Plains in response to the aridity of the Altithermal. The theories regarding where the McKean Complex originated and how it came to be on the Northern Plains will be examined in this thesis.

1.2 Objective

The objective of this research is to examine the nature of the McKean Complex on the Northern Plains across time and space. By using the systematic placement of these sites and their associated radiocarbon ages, a comprehensive database of the McKean Complex will be created. Further examination of the characteristics of each site may provide additional information regarding how this complex changed in relation to space and time. This research will provide additional understanding through the testing of existing theories of McKean dispersion, movement, and origins from a geographic approach. Through this analysis the following questions will be answered:

1. Where does the McKean Complex originate?
2. Was there a northward movement of the McKean Complex?
3. What is the nature of the spread of this technology?
4. What patterns are present in the McKean Complex over time and across space?

Both published data and unpublished data will be examined in this research project. The additional use of unpublished data provides a more complete assessment of the archaeological record. This literature is available throughout Canada and the United States in the form of reports of Cultural Resource Management (CRM) projects that are legislatively required in advance of development. These documents are rarely examined or retrieved after completion of the projects, but they contain much pertinent information that can be exploited to provide a more complete picture of the archaeological record. These documents were accessed through the provincial heritage offices in Canada and the State Historical Preservation Offices (SHPO) in the United States.

The focus of this research is on the use of radiocarbon ages to map and gain an understanding of the movement of the McKean Complex. By using radiocarbon ages and location data, researchers can examine cultural movement and the spread of technological

innovations. Archaeologically, this has been done to examine the movement of cultures across North America (Hamilton and Buchanan 2007; Hazelwood and Steele 2004), the collapse of the Classic Maya (Bove 1981; Kvamme 1990), the spread of agriculture through Europe (Ammerman and Cavalli-Sforza 1971; Bocquet-Appel et al. 2009), the Neolithic transition in Europe (Ammerman and Cavalli-Sforza 1984; Gkiasta et al. 2003), the interaction between *Homo sapiens* and *Homo neanderthalensis* (Boqcuet-Appel and Demars 2000), the distribution of the Oxbow Complex (Spurling and Ball 1981), and movement patterns of the Central Plains Tradition (Roper 1976).

While examining this complex with regard to radiocarbon ages and site locations will provide insight into predicted origins and movement patterns, further characteristics must be examined to provide a more complete picture of the people living during this time period. Therefore, to examine any underlying structures or patterns that may be present, site characteristics will also be considered to provide further insight into the relationship between site location and site characteristics across space and time. These characteristics will help provide measureable parameters concerning each site in relation to one another.

1.3 Chapter Summary

This thesis is divided into three main sections. The first section provides an introduction of the thesis and background information pertinent to this research, outlined in chapters one through four. The second component, chapters five through seven, provides a comprehensive examination of the McKean dataset, research methods used in this research as well as the interpretation of the results. The last section, outlined in Chapter 8, is a summary and suggestions for further research and conclusions.

Chapter 1 provides an introduction to the research problem of this thesis. It also outlines the objectives of the study and provides a chapter summary. Chapter 2 is an introduction to the Study area, examined through environmental and cultural components. Chapter 3 provides a background of the development of the cultural chronology for the Northern Plains region and discusses the cultural chronology of the Northern Plains. Chapter 4 examines previous research of the McKean Complex, including past and current research pertaining to typology, subsistence, settlement, origins, migration, cultural interaction and transmission.

Chapter 5 provides an overview of the McKean sites being examined in this thesis. Chapter 6 discusses the research methodology used for this thesis. It includes an overview of GIS in archaeological research, a literature review, data collection methods and the GIS methods used to analyze the data collected for this research. Chapter 7 provides results of the research and the interpretation of the results of this study through an examination of cultural transmission, palaeo-environmental factors, movement patterns and settlement patterns. To provide a more holistic view, other archaeological cultures that occur around the same time are also discussed to complete the demonstration of how these interactions between cultures are derived from the archaeological data.

Chapter 8 provides the conclusion for this study. It provides an overview of the findings, interpretations, and conclusions of the data examined resulting from this research. The topics covered in this thesis provide much fodder for future research and suggestions for further research are also discussed in this chapter.

Chapter 2: Study Area for the McKean Complex – Environmental and Cultural Components

2.1 Introduction

The study area for this thesis comprises the Northern Plains and the northern fringe of the Central Plains and their peripheries. While many people view this region as a flat grassland, in reality it contains a wide array of features suitable for human habitation. This area is contained within the Great Plains Ecozone and the surrounding mountainous regions. This chapter will include an overview of the Great Plains and an overview of the study area in which McKean sites are found followed by a description of the paleoenvironment of this area.

2.1.1 The Great Plains

The Great Plains is a vast land-bound area in the interior of North America. The Great Plains extends north from Mexico to southern Canada and east from the Rocky Mountains to the Eastern Woodlands (Figure 2.2) (Kay 1998:16; Wedel 1964:20-45). This area lacks precise boundaries though it has a close correspondence to the Northern Interior Grasslands (Kay 1998:16; Shelford 1963:328-355). The Great Plains has a dry continental climate, is known to be an area of high winds and is subject to extreme and periodic droughts and frosts. The climate is highly variable from north to south as well as within individual regions (Strahler and Archibold 2008:194-195).

While much of the Plains has low or moderate relief it exhibits diverse terrain, within this region one can find gullies, terraced river valleys, sand dunes, table lands, flat lands, hilly and mountainous regions, and intermontane basins (Wedel and Frison 2001:44). While generally regarded as featureless grassland, there are many biogeographical islands and ecological patches, which are distinct from the surrounding Plains, that people have gravitated towards throughout prehistory (Kornfeld et al. 2010:28; Osborn and Kornfeld 2003:1).

On the Great Plains, there are three general grassland zones: short grass, mixed grass, and long grass. The type of grass one will encounter in each zone is related to the amount of rainfall received in that area. Rainfall increases from west to east so one will generally find short grass in the west, transforming to a mixed grass in the central areas and tall grass in the wetter eastern areas (Commission for Environmental Cooperation 1997:27; Kornfeld et al. 2010:27). However,

the Great Plains was not always grassland. From approximately 14,000 – 12,000 B.P., spruce forests spread as far south as Kansas and the Plains to the south were covered with deciduous forests (Trimble 1980). The trees slowly retreated northwards with the receding ice sheet and grasslands have been replacing the forests for the past 8,000 to 10,000 years (Trimble 1980). Within the grasslands, treed areas occupy many of the major river valley floodplains, scarp lands, hilly and mountainous regions, intermontane basins, and stream valleys (Wedel and Frison 2001:44). Today, the forests are expanding southwards due to settlement and the subsequent reduction of prairie fires (Commission for Environmental Cooperation 1997:27).

The Great Plains can be divided into five broad cultural and geographic areas: the Northwestern Plains, the Northeastern Plains, the Middle Missouri, the Central Plains, and the Southern Plains as shown in Figure 2.1 (Wood 1998:11). These are subjective boundaries based on cultural and geographic commonalities (DeMallie 2001:1). Cultural areas, like the borders of the Plains, do not have definite boundaries and are determined by ecological settings as well as by the cultural systems of the people who lived there (Wood 1998:11). "The ecological differences are reflected in the distinctive cultural adaptations of the nomadic tribes to the high plains and the semi-sedentary horticultural tribes to the prairie plains" (DeMallie 2001:1). These subdivisions are used to study culture histories on the Plains (Wood 1998:10). Evidence of exotic trade items associated with many of the archaeological cultures demonstrate that there was interaction between groups within these cultural areas as well as those areas located outside of the Plains region.

2.1.2 The Study area

The study area encompasses the region inhabited by the people of the McKean Complex that was present on the Northern Plains from approximately 5000 to 2500 B.P. It includes parts of what is currently known as southern and central Alberta, Saskatchewan, and Manitoba, as well as parts of Montana, Wyoming, Colorado, Nebraska, North Dakota, and South Dakota. Most of this area is located in what is known as the Northern Plains. The Northern Plains is comprised of the Northwestern Plains, Northeastern Plains, and the Middle Missouri regions (Figure 2.1). The McKean Complex was also present in peripheral areas such as the northern edge of the Central Plains, the Northern Forests, the Northwestern Forested Mountains, and the North American Deserts (Figure 2.1).

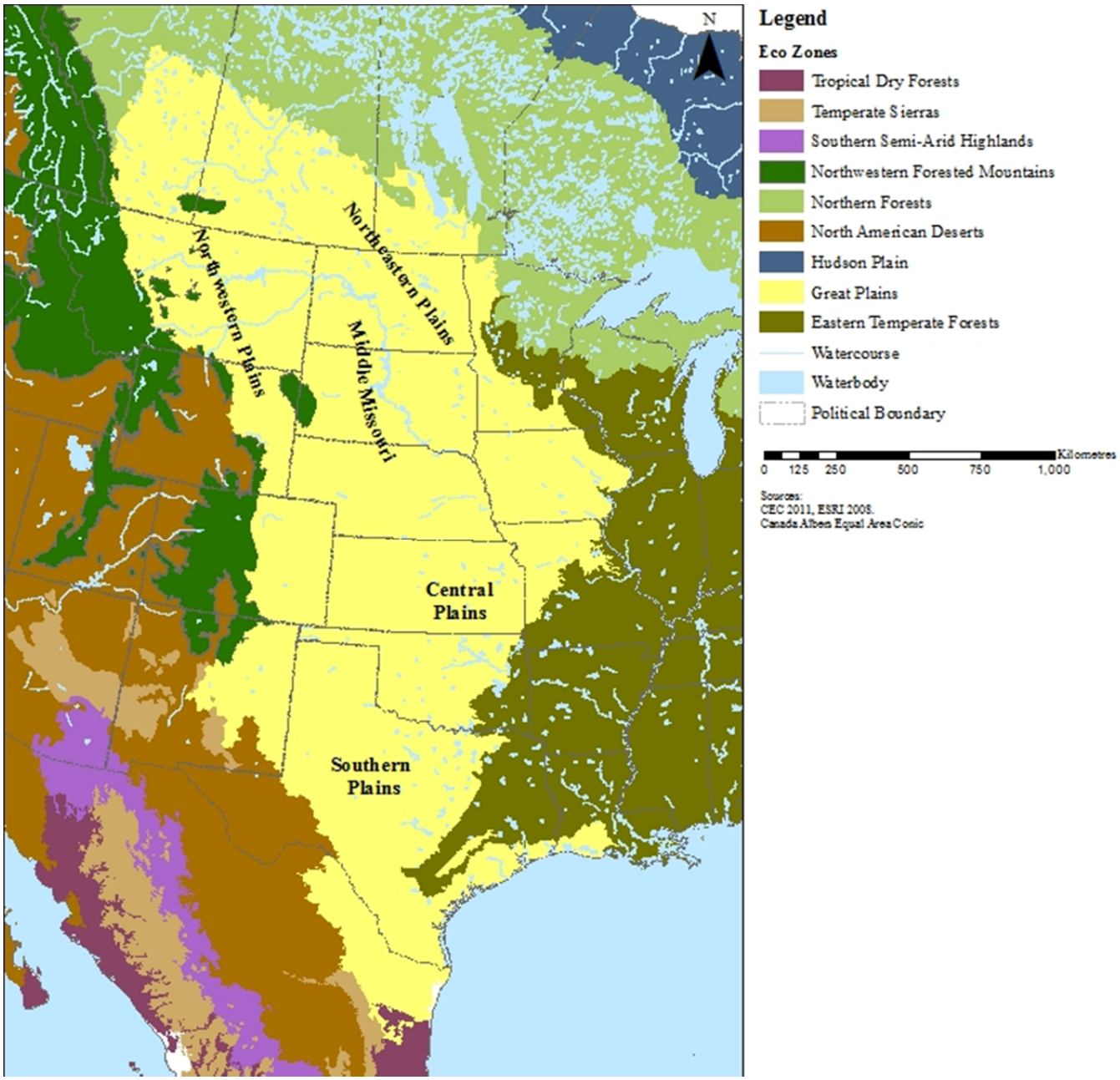


Figure 2.1 The Great Plains and Associated Cultural Regions (CEC 2011; ESRI 2008)

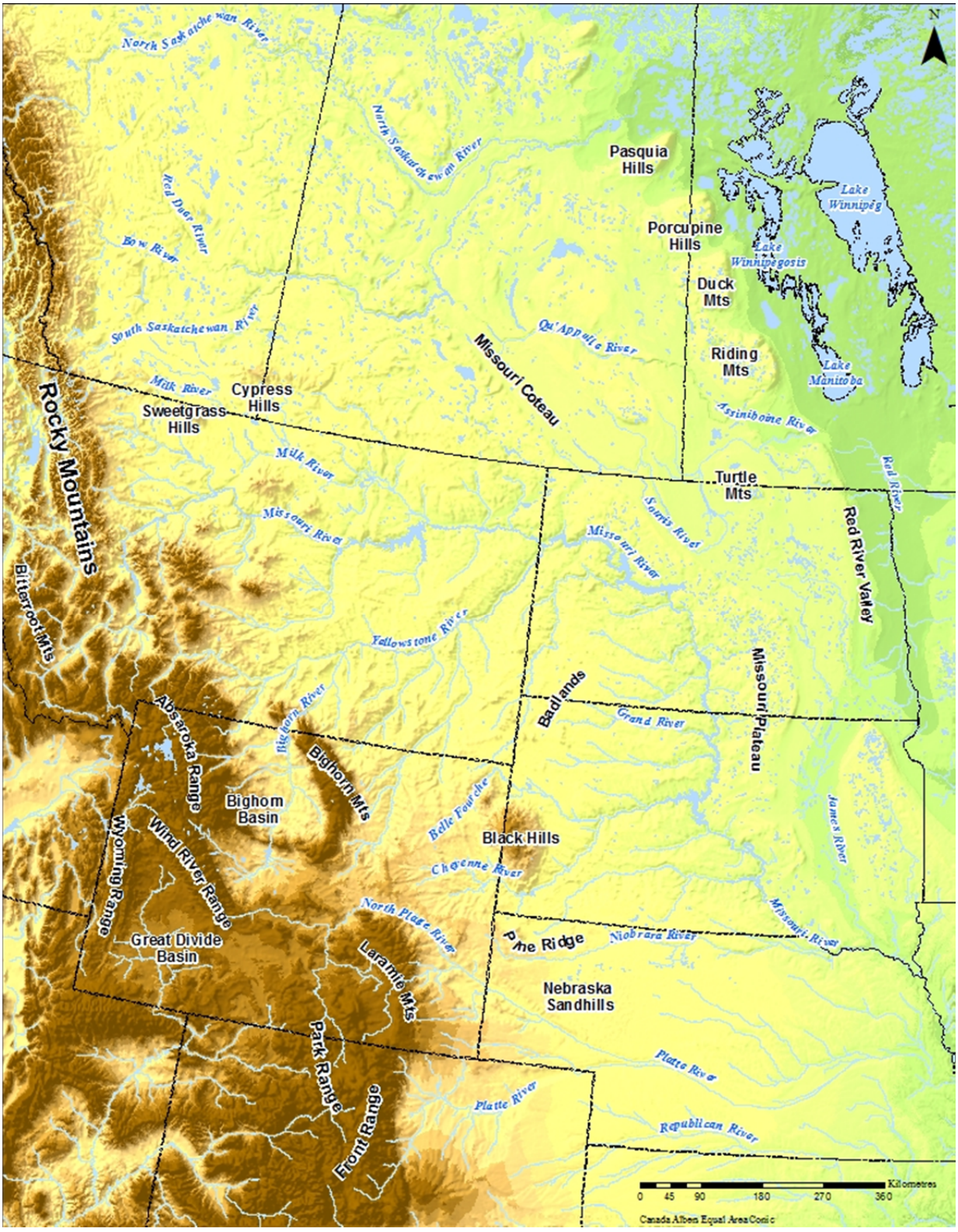


Figure 2.2 Physical Geography of the Study area (ESRI 2008)

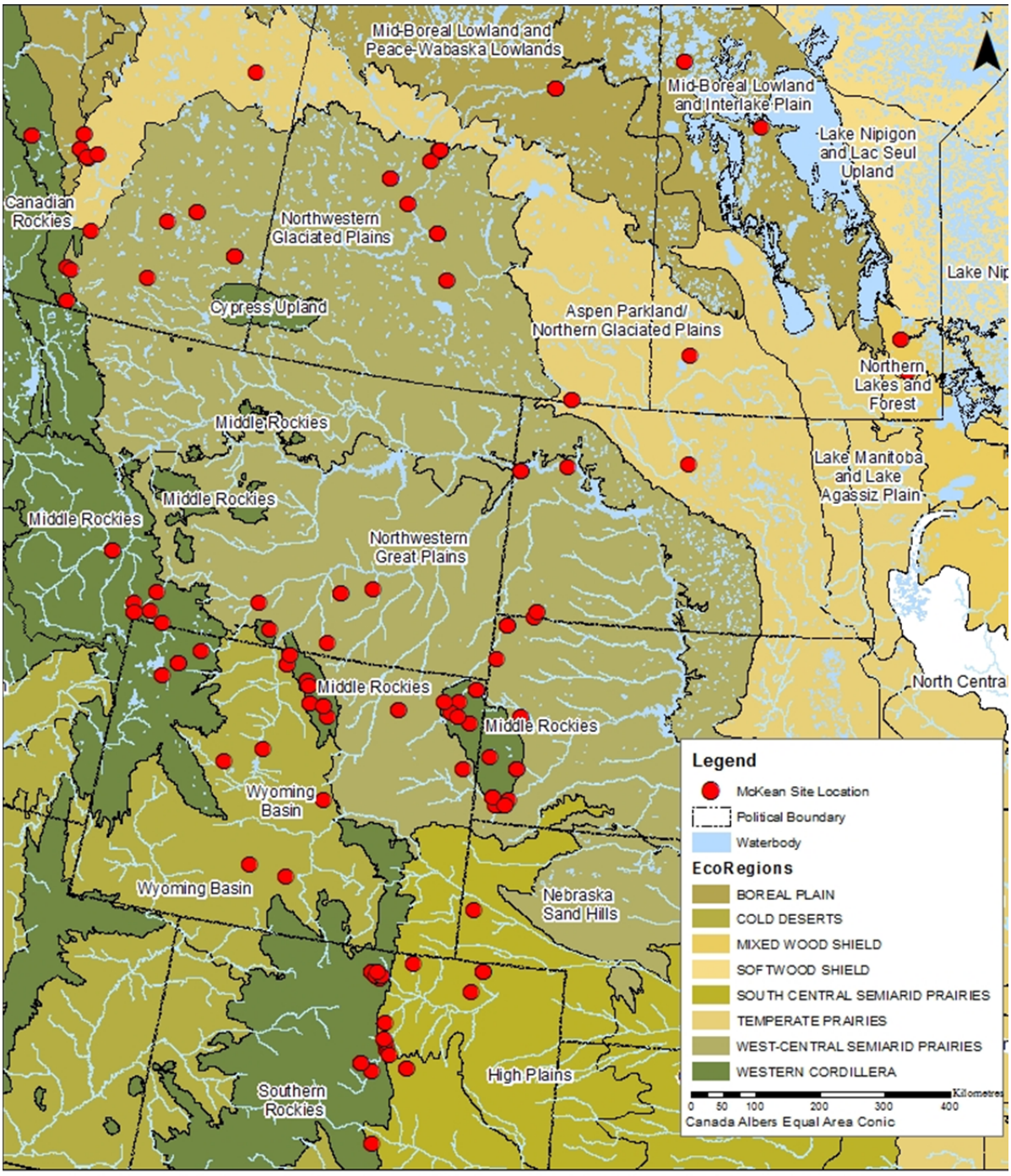
Within the study area there are many diverse landscapes breaking up the uniformity of the plains. The study area contains river valleys, mountains, uplands, escarpments, sand dunes, lakes and rivers. Figure 2.2 displays some of these areas. Rivers present riparian and associated vegetation communities along their banks (Osborn and Kornfeld 2003:2). Major river systems include the North and South Saskatchewan leading to the Saskatchewan River, and the Bow, Red Deer, Milk, Qu'Appelle, Assiniboine, Missouri, Yellowstone, Souris, Bighorn, Belle Fouche, Cheyenne, North Platte, Platte, Grand, and Niobrara rivers, which contribute to the diversity of floral and faunal communities on the Plains. These rivers also provide reliable water sources as well as potential travel passageways (MacDonell and Wandsnider 2003:89-110). Other areas include mountainous or hilly regions, badlands, sand dunes, valleys and basins. These all provide a change in resources available from the Plains region offering a variety of vegetation, fauna, materials, and shelter. Examples of these geographical features in the study area include (but are not limited to) the Black Hills, the Missouri Coteau, Cypress Hills, the Bighorn Mountains, Pasquia Hills, the Porcupine Hills, the Sweetgrass Hills, the Red River Valley, the Missouri Coteau, Nebraska Sandhills, Bighorn Basin, Great Divide Basin, Turtle Mountains, Duck Mountain, Moose Mountain, and Riding Mountains.

The Northern Plains includes three cultural and geographic subsections: the Middle Missouri, Northwestern and Northeastern Plains (Figure 2.1). Bordering the Northern Plains to the north is the Northern Forest comprised of boreal forests on the Canadian Shield (Wiken et al. 2011). To the east are the Eastern Temperate Forests composed of a diverse forest and a milder and more humid climate (Wiken et al. 2011). The Northwestern Forested Mountains and the North American Deserts are found to the west. The Northwestern Forested Mountains are a mountainous region with a diverse range of ecosystems (alpine tundra, conifer forest, grasslands, etc.). The North American Desert region is noted for its aridity and desert like climate, low relief, lack of trees and unique vegetation (Wiken et al. 2011). To the south is the Central Plains. McKean sites have been found in all of these areas.

To provide a greater understanding of the ecological regions in North America each larger Ecozone is further subdivided into smaller, more localized Ecoregions that are similar in type and quality of environmental resources (Wiken et al. 2011), and these can be further subdivided into Ecodistricts. The Corporation for Environmental Cooperation describes these Ecoregions as levels 1-4. Level 1 corresponds to Ecozones, level 2 and 3 to varying levels of

Ecoregions and level 4 to Ecodistricts. This research will examine each of the level 3 Ecoregions in the Study area to provide information about the current environment in which McKean sites are found (Table 2.1). These divisions provide a modern classification of the components of an ecosystem including water, land, flora, fauna, air, and human usage (Wiken et al. 2011). The level 3 Ecoregions will be further examined in Chapter 7 with regard to sites associated with each Ecoregion as well as prehistoric floral and faunal associations.

Figure 2.3 shows the location of the McKean sites being examined in this study. From their placement it is possible to get a general boundary of where McKean sites are located, comprising the Study area. No boundary is shown on this figure because not all McKean sites are shown. Sites that are not shown on this map, and that will not be examined here, include surface scatters and artifact find locations. The Study area is the general area surrounding and between the site locations shown on this map. This map also shows site location in relation to level 2 and 3 Ecoregions.



(Arthur 1966; Boen 2013; Brumley 1975; Butchner 1979; Cahill 2012; Calder 1977; CEC 2011; Davis 1976; Davis et al. 2014; Dyck 1983; Dyck and Morlan 1995; ESRI 2008; Fedje 1986; Finnigan et al 1983; Floodman et al. 1997; Forbis 1985; Frary 2009; Fredlund 1979; Frey 1997; Frison 1991; Frison and Huseas 1968; Gilmore et al. 1999; Hanna and Head 2000; Haug 1975; Head et al. 2003; Hjermstad 1998; Husted 1962; Husted and Edgar 2002; Johnson 1975; Keyser and Davis 1984, 1985, and 1999; Kornfeld 1995; Kornfeld and Frison 1985; Lahren 1976; Lobdell 1974; Mack 2000; MacNeish 1958; Malasiuk 2007; Morlan n.d.; Munson 1992; Pletz 2010; Quigg 1986; Ramsay 1993; Reeves 1972; Reher et al. 1985; Rennie and Hughes 1998; Ruebelmann 1982; Steege and Paulley 1964; Stine et al. 2001; Stuart 1990; Syms 1969; Tamplin 1977; Toom 1983; Wettlaufer and Meyerr-Oakes 1960; Wheeler 1995a; 1995b; 1995c; Wilson 1983; Wilson 1984)

Figure 2.3 General Study area in Relation to Ecoregions

Table 2.1 Characteristics of Ecoregions (Level 3) in the Study area

EcoDistrict	Description	Climate	Flora	Fauna	Prominent Features
Mid-Boreal Uplands and Peace-Wabska Lowlands	Upland areas covered with lacustrine and moraine deposits, hummocky uplands, and gently sloping deposits	Humid continental climate (short cool summers and cold winters)	Trembling aspen, balsam poplar, black and white spruce, balsam fir with an understory of shrubs and herbs.	Elk, moose, white-tailed deer, black bear, coyote, timber wolf, lynx, snowshoe hare, cottontail, muskrat and beaver.	Many lakes, streams and rivers. Rivers include the North and South Saskatchewan, Saskatchewan, Beaver, Red Deer, Assiniboine, and Carrot.
Mid-Boreal Lowland and Interlake Plain	Rolling to flat lowlands covered with glacial moraine and lacustrine deposits	Severe mid-latitude humid continental climate (warm summers and cold winters)	Native vegetation includes aspen stands with balsam poplar with an understory of tall shurbs and mixed herbs. Dry, sandy areas have tall jack pine. Wet or low areas have sedges, willow, tamarack and black spruce.	Black bear, white-tailed deer, moose, beaver, coyote, snowshoe hare, eastern cottontail, waterfowl, pelican and grebe.	Large lakes such as Lake Winnipeg, Cedar Lake, and Lake Winnipegoisis. North Saskatchewan River.
Lake Nipigon and Lac Seul Upland	Canadian Shield with uplands and lowlands that contain outcrops and covers of moraine	Severe mid-latitude humid continental climate (warm summers and very cold winters)	Coniferous forest with some mixed forest. Vegetation includes white spruce, black spruce, balsam fir, trembling aspen, balsam poplar, jack pine. Poorly drained areas contain black spruce.	Wolf, ermine, fisher, lynx, mink, black bear, moose, woodland caribou, snowshoe hare, red squirrel, birds and waterfowl.	Many small lakes and moderate to high density of rivers. Many wetlands
Northern Lakes and Forest	Contains glaciated, irregular plains, undulating morianal plains and hills, extensive washout basins, and broad lacustrine basins	Severe mid-latitude, humid continental (warm summers and severe winters)	Mostly coniferous and northern hardwood forests. Species include sugar maple, red maple, yellow birch, paper birch, aspen, balsam fir, white spruce, hemlock, eastern white pine, jack pine, red pine, black spruce, tamarack and northern white cedar.	Moose, black bear, gray wolf, white-tailed deer, snowshoe hare, lynx, birds and fish.	Numerous glacial lakes and moderate to low gradient perrenial streams.
Lake Manitoba and Lake Agassiz Plain	Flat to low rolling plains composed of moraine and lacustrine deposits. Thick beds of sediments (on top of glacial till) created from the floor of Glacial Lake Agassiz creating the Lake Agassiz Plain.	Severe mid-latitude humid continental climate (warm summers and cold winters)	Trembling aspen, oak groves, and rough fescue grasslands in the north. In the south cottonwood, willow, bur oak, elm and green ash. Historically tall grass prairie.	Waterfowl, coyote, jackrabbit, white-tailed deer, red fox, raccoon, sharp-tailed grouse, cottontail, ground squirrel and fish species.	Few low gradient streams and river networks with common late winter flooding.
Aspen Parkland/Northern Glaciated Plains	Flat to undulating broad plains composed of glacial moraine and lacustrine and hummocky fluvio-glacial deposits with deeply incised valleys	Severe, humid continental to dry mid-latitude steppe (short warm summers and long cold winters)	Trembling aspen, balsam poplar, oak groves, mixed tall shrubs, herbs, fescue grasses, big and little bluestem, green needlegrass, western wheatgrass, blue grama, and switchgrass.	Elk, muledeer, whitetailed deer, coyote, snowshoe hare, red fox, sharp-tailed grouse, cottontail, northern pocket gopher, Franklin's ground squirrel, and varies of waterfowl	North Saskatchewan, Souris, Assiniboine, South Saskatchewan, Battle, and Qu-appelle river valleys. Manitou, Jackfish, Lenore, Quill, Little Quill, Basin, Kenosee, Good Spirit, and Qu-appelle Lakes
Northwestern Glaciated Plains	A broad plain with deeply incised valleys and hilly uplands created from outwash, moraine, and glacio-lacustrine sediments. A transitional area between the northern glaciated plains and the plains to the south. Areas with high concentration of seasonal wetlands.	Dry mid-latitude steppe climate (warm to hot summers and cold winters)	Short to mixed grasses, shrubs, herbs, sagebrush, prickly pear, cactus, aspen, willow, cottonwood, box elder alkal grass, greasewood, wild barley, sea blite and red sampire.	White-tailed deer, pronghorn, bobcat, sage grouse, jackrabbit, short-horned lizard, coyote, prairie dog, ground squirrel, western diamondback rattlesnake, golden eagle and ferruginous hawk.	South and western extent coincides with approximately the furthest extent of the Laurentide ice sheet. Rivers include the South Saskatchewan, Souris, and Qu'Appelle. Lakes include Muddy, Tramping, Goose, Little Manitou, Buffalo Pound, Last Mountain, and Diefenbaker.
Northwestern Great Plains	Unglaciated rolling plain with occasional buttes dissected by rivers and badland terrain.	Dry mid-latitude steppe climate (warm to hot summers and cold winters)	Short and mixed grass prairie including blue grama, gren needlegrass, buffalo grass, western wheatgrass, and prairie sandreed. Sagebrush, Rocky Mountain juniper and ponderosa pine are also found here.	White-tailed deer, bobcat, cougar, pronghorn prairie dog, jacrabbit, ferruginous hawk, golden eagle, meadowlark, sage grouse, sage thrasher, northern pintail and prairie rattlesnake.	Missouri River, as well as epermeral and intermittent streams.
High Plains	Landforms are smooth to irregular.	Dry mid-latitude steppe (hot summers and cold winters)	Short and mid-grass prairie of buffalograss, sideoats grama, blue grama, fringed sage, little bluestem, and wheatgrass. Other species include sand sagebrush, prairie sandreed, sand bluestem, little bluestem, sand dropseed, Indian ricegrass, Harvard shinoak, ucca and fourwing saltbush.	Historically bison, black-footed ferrets, cougars, black-tailed prairie dogs, and grey wolf. Today pronghorn, swift fox, coyote, jackrabbit, ferruginous hawk, cottontail and lesser prairie chickens.	Watersources in the area include intermittent and ephermeral streams, ephermeral pools, playas and larger rivers such as the Platte, Arkansas and the Cimarron.

Table 2.1 Characteristics of Ecoregions (Level 3) in the Study area (Continued)

EcoDistrict	Description	Climate	Flora	Fauna	Prominent Features
Wyoming Basin	Broad intermontane basin with high hills and low mountains. Badland areas, piedmont plains and peidmonts	dry mid-latitude steppe and desert climate (warm to hot summers and cold winters).	Shurblands and arid grasslands with species such as Wyoming big sagebrush, fringed sage, western wheatgrass, black sagebrush, rabbitbrush, needle and thread grass, junegrass, blue grama, greasewood, shadcale, bud sage gardner saltbush, big sagebrush and pinyon-juniper.	Cougar, bobcat, mule deer, coyote, jackrabbit, pronghorn, white-tailed prairie dog, prairie falcon, golden eagle, sage grouse and Wyoming toad.	Intermittent and ephemeral streams and seasonal playas.
Canadian Rockies	Steep mountain ranges with isolated patches of permafrost at higher elevations. Peaks and ridges are charaterized by rocky outcrops, slopes covered with moraine and colluvium	Severe mid-latitude continental climate with subarctic climate at higher elevations	Mixed forests of lodgepole pine, alpine fir, and Engelmann spruce. Valley systems are composed of Douglas Fir stands with trembling aspen and grasslands. Alpine fir can be found at higher elevations.	Elk, mule deer, bighorn sheep, moose, wolf, caribou, black and grizzly bear, cougar, mountain goat, marten, bobcat, lynx, wolverine, white-tailed deer, boreal owl and snowshoe hare.	Low to moderate density stream and river networks. Steep mountain ranges.
Middle Rockies	High alpine glaciated mountains, intermontane basins and plateaus.	Severe mid-latitude continental at lower elevations (warm to cool summers and severe winters) and subarctic climate at higher elevations	Douglas fir, aspen, subalpine fir lodgepole pine, and Engelmann spruce. Grasslands and meadows are also found. The foothills are partially wooded with shurb and grass cover. The intermonane valleys areas are also grass and shrub covered.	Moose, black bear, cougar, mountain goat, bobcat, white-tailed deer, mule deer, marmot, northern flying squirrel, golden eagle, boreal toad and many bird species.	Many high gradient streams and rivers feeding the surrounding regions.
Southern Rockies	Composed of steep rugged mountains with linear ranges, complex masses of peaks and high intermontane valleys.	Severe mid-latitude humid continental climate (warm summers and cold winters) and subarctic climate at higher elevations	High elevation species include cushion plants sedges, alpine low shrubs, stunted fir, pine and spruce. Mid elevations have forests of subalpine fir, aspen and Englemann spruce.	Mule deer, elk, bighorn sheep, lynx, cougar, wolverine, marmot, snowshoe hare, pika, fish and bird species	Medium to high gradient streams and rivers and high alpine lakes
Southwest Tablelands	Located between the High Plains and the Southern Rockies. An elevated area of rolling to flat plains dissected by canyons, mesas, badlands, gorges and river breaks.	Dry mid-latitude steppe climate (hot summers and cool winters)	Mostly short to mid grass prairie with blue grama, black grama, sideoats grama, sand dropseed, little bluestem, threeawns, western wheatgrass buffalograss, galleta, sagebrush, yucca and cholla. Areas of pinyon pine, Rocky Mountain jumiper, scrub oaks, redberry juniper and mountain mahogany. Riparian areas have willow, elk, cottonwood and hackberry.	Mule deer, pronghorn, coyote, ringtail, black-tailed prairie dog, desert cottontail, kangaroo rat, pocket mouse, scaled quail, Swainson's hawk, burrowing owl, lark sparrow, rattlesnake, and prairie skink. Historically bison, wolve, prairie dog and black-footed ferret.	Water is scarce. Major rivers include the Arkansas, Canadian and Pecos.

(Acton et al. 1998; Wiken et al. 2011)

2.1.3 Paleoenvironmental Considerations

The Northern Plains were formed by numerous glacial cycles with the last, known as the Wisconsinan glaciation, occurring from 80,000 to 12,000 years B.P. (Dyke and Prest 1987). During this Late Pleistocene event there were two major ice sheets that covered much of northern North America, the Laurentide and Cordilleran. Together these ice sheets covered much of Canada and the northern United States, reaching their farthest southern extent around 18,000 B.P. (Figure 2.4). The Cordilleran ice sheet was located west of the Rocky Mountains and the Laurentide east of the Rocky Mountains. The advance and retreat of these glaciers molded the landscape by eroding the underlying sediments, carrying them within the ice sheet, and depositing them in meltwater channels, glacial lakes, moraines, eskers, drumlin fields, and outwash plains. These geomorphic features laid the groundwork for the Northern Plains landscape that we see today.

South of the Missouri River the Northern Plains were not covered by ice sheets during the last glaciation event. The generalized surficial geology is composed of glacial deposits, alluvium, sand dunes, and loess (windblown silt deposits). Melting ice at the ice front provided large volumes of meltwater that flowed across the till-mantled periglacial surface (Trimble 1980:35).

Since the last glacial maximum dramatic climate changes have taken place. The dynamic paleoenvironmental record suggests that animals, plants, and human populations were all affected by climate during the Holocene in North America (Stahl 1996:107). Using pollen, the mammalian fossil record, and plant macrofossil data a reconstruction of the paleoenviornment can be performed and is illustrated in Figure 2.4 (Dyke et al. 2004). This figure indicates how the environment and respective biomes changed with the retreat of the glaciers and where these biomes were located at specific time intervals.

With the retreat of the ice sheets the Holocene began about 11,000 B.P. (Table 2.2). General trends of the Holocene were a warmer and drier environment during the first 5,000 years while the latter half had a cooler and moister environment with episodes of aridity similar to the early years (Dyck 1983; Leyden et al. 2006:89). The Holocene is typically divided into three periods: the Early Holocene (11,000 – 7,000 years B.P.), Mid-Holocene (7,000 – 5,000 years

B.P.), and the Late Holocene (5,000 years B.P. – present), each connected by a transitional period.

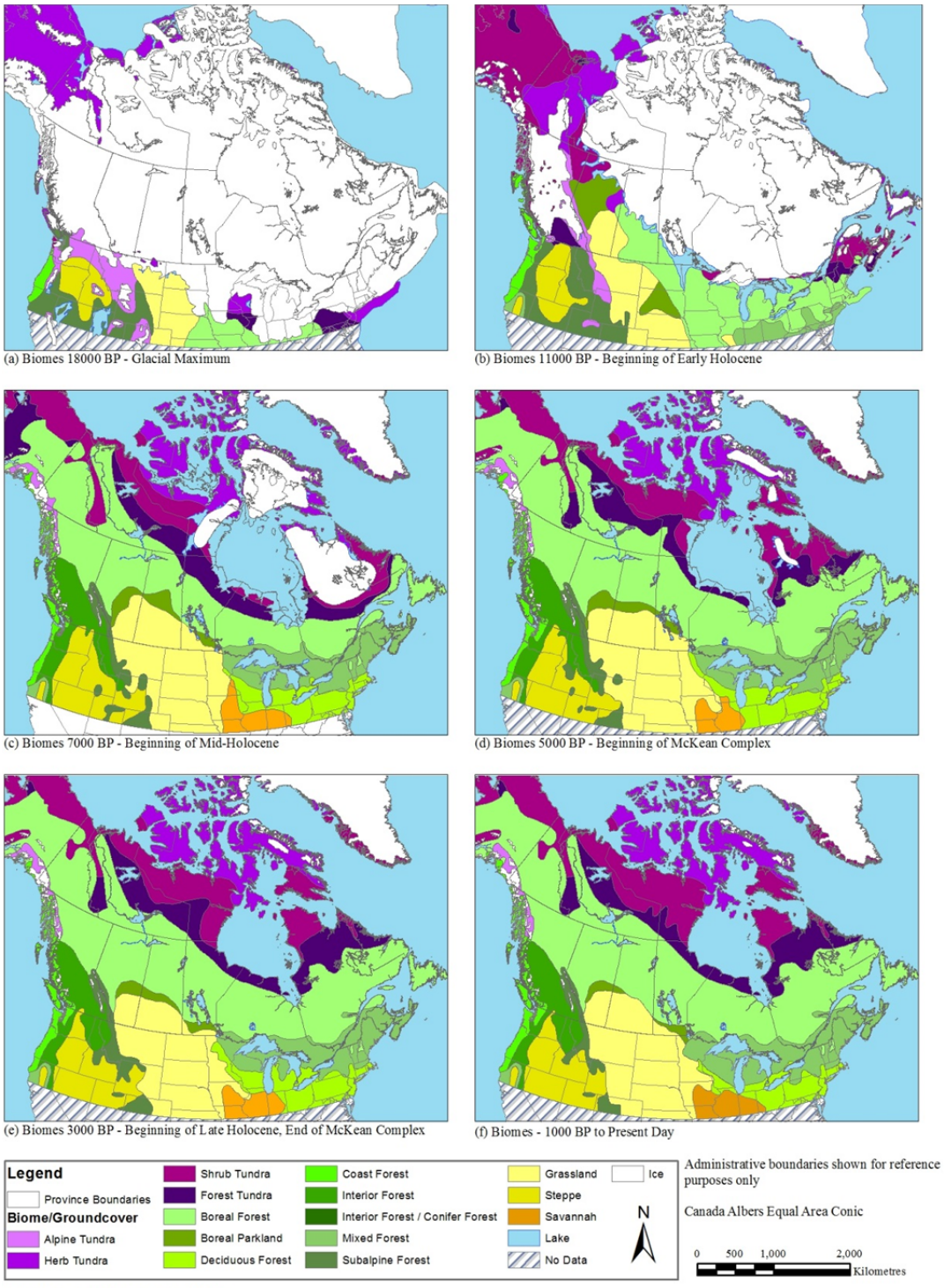


Figure 2.4 Biomes 18,000 B.P. to Present

Table 2.2 Post-Glacial Climatic Models (modified from Ruebelmann 1982)

<table>
<tr><th>Years BP</th><th>Holocene</th><th>Neothermal Model (Antevs 1955)</th><th>Hypsithermal Model (Deevey and Flint 1957)</th><th>Blytt-Surnander Sequence in Northern Europe</th><th>Cave Rockfall Frequency in NW USA (Fryxell and Daugherty 1963)</th></tr>
<tr><td>Present</td><td rowspan="3">Late Holocene</td><td rowspan="3">Medithermal (Cooler, Moister)</td><td rowspan="2">Hypothermal (Cooler)</td><td rowspan="2">Subatlantic (Colder and Wetter)</td><td>Present Conditions</td></tr>
<tr><td>1000</td><td>Warmer, Dryer</td></tr>
<tr><td>2000
3000</td><td rowspan="5">Hypsithermal (Warmer)</td><td rowspan="3">Sub-Boreal (Warm, Dry)</td><td rowspan="3">Cooler, Moister</td></tr>
<tr><td>4000
5000</td><td rowspan="2">Mid-Holocene</td><td rowspan="2">Altithermal (Warm, Dry)</td></tr>
<tr><td>6000</td><td rowspan="3">Atlantic (Warm Maximum, Moist, Oceanic)</td><td rowspan="2">Maximum Warmth and Drought</td></tr>
<tr><td>7000</td><td rowspan="4">Late Pleistocene/ Early Holocene</td><td rowspan="4">Anathermal (Cool)</td></tr>
<tr><td>8000</td><td>Brief Cold</td></tr>
<tr><td>9000</td><td rowspan="3">Anathermal (Cool)</td><td>Boreal (Rising Temp., Dry)</td><td>Abrupt Warming Trend</td></tr>
<tr><td>10000</td><td>Pre-Boreal (Rising Temp., Cool)</td><td rowspan="2">Fluctuating Cool, Moist Conditions</td></tr>
<tr><td>11000</td><td>Arctic (Cold)</td></tr>
</table>

At the Late Pleistocene/Early Holocene transition, climatic conditions were relatively warmer than the conditions at the end of the glaciation (Leyden et al. 2006:89). The Early Holocene produced trends of a cool moist environment gradually warming to a hotter and drier environment. The retreating ice had strong control over the continental climate until approximately 7,000 years B.P. (Dyke et al. 2004).

The Mid-Holocene lasted from 7,000 to 5,000 years B.P. (Deevey and Flint 1957:183). The hottest and driest environment yet occurred during this interval. This corresponds to a maximum northward expansion of the grasslands and low lake levels due to the aridity of the environment (Vance et al. 1995). The warmest and driest time on the Plains began around 9,000 – 7,000 years B.P. continuing until 6,000 – 4,000 years B.P. (Anderson et al. 1989:528; Barnosky 1987:71-72; Vance et al. 1995:93-94) and is known as the Mid-Holocene Climatic Optimum (Leyden et al. 2006:90). Evidence shows that there was not a continuous drought during this period, but rather shorter periods of droughts interspersed with periods of increased moisture (Leyden et al. 2006:90).

It was once thought that a cultural hiatus occurred on the Plains from approximately 7,500 to 5,000 years B.P. (Mulloy 1958), though this hypothesis is no longer generally accepted. Because this was the warmest and driest period known on the Plains, early researchers

hypothesized that a lack of archaeological sites during this time indicated the Plains were abandoned (Mulloy 1958:208-209). Not everyone agreed with this hypothesis. Hurt (1966:110) argued that the Plains were never completely abandoned and that people may have sought refuge near major water sources. Wedel (1978:199) suggested that due to the arid environment people may have abandoned the short grass plains to move into the more temperate conditions along the periphery of the plains. It is generally accepted that there was a reduction in population during this time in this region and people congregated to areas with more reliable food sources. This led to concentrations of sites in more hospitable areas (Buchner 1980:205; Hurt 1966:111; Husted 2002; Kornfeld et al. 2010; Sheehan 1995:268; Walker 1992).

The Late Holocene began with a cool and wet climate then evolved to modern climate conditions around 3,000 BP (Vance et al. 1995) characterized by warm and dry periods alternating with cool moist periods (Leyden et al. 2006:90). During this time an increase in lake levels indicates less arid conditions (Leyden et al. 2006:90).

Chapter 3: Cultural Chronology Background

3.1 Introduction

To understand one archaeological cultural group it is essential to examine other known cultures to help understand how they relate to one another across space and time. When examining archaeological cultures one must be cautious as the people we are studying were not likely unified groups distinguished by the characteristics that we use to define them. They were groups in a constant state of change that evolved over time because cultures are open systems, constantly changing in response to their natural surroundings as well as their own and other cultural systems (Wood 1998:13). Referring to ancient people as an archaeological construct does not take into account the variability or diversity within these groups of people; only how archaeologists use the material culture left behind to identify people who lived in the past.

To understand how archaeologists categorize cultures a number of terms require definition. To begin, an archaeological culture defines a similar assemblage of artifacts and features during a specific time period and common geographical area (Renfrew and Bahn 2004:579). A component is the smallest unit representing a single occupation within a site (McKern 1939). Components many have been deposited in different years or by different people but are considered the same culturally. Therefore, each level that we examine may not be a single point in time but a multitude of occupations over time, where people periodically stayed in an area repeatedly over many years. A locality is the smallest area occupied by a single community ranging in size of a single site to an area of uncertain size (Willey and Phillips 1958: 619).

A phase is defined as:

> a space-time-cultural unit possessing traits sufficiently characteristic to distinguish it from all other units similarly conceived, whether of the same or other cultural traditions, geographically limited to a locality or region and chronologically limited to a relatively brief span of time (Willey and Phillips 1958:620).

A period is similar to a phase but with more emphasis on space and time (Willey and Phillips 1958:624).

An archaeological complex is defined as:

> a large composite archaeological unit. It consists of interconnected sites, features, and artifacts, tied together by similarities in function, style, technology, and subsistence-settlement. The parts of a complex are found within a common geographical distribution and within a common segment of time. The change in terms from culture to complex reflects the notion that an archaeological complex is not necessarily equivalent to an ethnological tribe or culture. It may be equivalent but it may also spread across ethnological groupings (Dyck 1983:69).
>
> A tradition refers to the cultural or technological elements of a complex that are; "diagnostic, which occurs in sequential complexes, passed down as it were from one to the other" (Dyck 1983:69).
>
> A series is defined as:
>
> A sequence of archaeological components sharing a common space (sometimes within a single site, sometimes within a region), but belonging within separate segments of time. [It] is a crude unit of archaeological analysis used for convenience before sites, features, and artifacts are ready for reclassification into complexes and traditions (Dyck 1983:69).

A horizon is defined as a style that "occupies a great deal of space but very little time. It may be briefly described as a spatial continuum represented by the wide distribution of a recognizable art style" (Willey and Phillips 1958:625).

On the Northern Plains artifacts that are typically used as diagnostic markers to create cultural chronologies include pottery and projectile points. Before the written record, projectile points are most commonly used as they are a common artifact across the plains, are durable, have measurable traits for comparative purposes, and have "evolve[d] over time and space as technologies are developed and transported" (Frary 2009:13).

3.2 Northern Plains Cultural Chronology

The cultural chronology of the Northern Plains has been divided into four major periods here following Walker (1992:120) as seen in Table 3.1. The chronologies designed by Mulloy (1958), Malouf (1960), Wheeler (1958), and Wormington and Forbis (1965) were not used for this research as they indicate a cultural hiatus from 7,500 to 5,000 BP. Current research has shown that there was no hiatus during this period that instead people moved to areas of more stable water supplies and other resources (Walker 1992). Dyck (1983) does not distinguish between Early, Middle and Late Middle Prehistoric. As this time period is the main focus of this research further distinction is required. Frison (1978) uses the term 'archaic' to describe cultural

groups of the Middle Period on the Plains. The term 'archaic' is used to describe a people who use a variety of sources for food acquisition instead of a specialized hunting strategy (Walker 1992:2-3) relying equally on plant and animal foods. Walker (1992:121) argues that "there is no discernible archaic adaptive stage on the Northern Plains that is any different from preceding or subsequent subsistence strategies". Studies of this time period in the United States use the term Archaic and not prehistoric as this adaptive strategy is present in sites further south. Both of these terms will be used in this thesis. For simplicity in this chapter the term prehistoric will be used to describe the Middle Prehistoric and Middle Archaic Period, though it has yet to be determined whether there are different subsistence strategies on the Northern Plains.

Table 3.1 Cultural Chronology of the Northern Plains (Walker 1992)

<table>
<tr><th>Years (B.P.</th><th colspan="2">Mulloy (1958)</th><th colspan="2">Frison (1978)</th><th>Dyck (1983)</th><th colspan="2">Walker (1992)</th></tr>
<tr><td>200</td><td colspan="2">Historic</td><td colspan="2">Historic</td><td>Historic</td><td colspan="2">Historic</td></tr>
<tr><td>2000</td><td colspan="2">Late Prehistoric</td><td colspan="2">Late Prehistoric</td><td>Late Plains Indian</td><td colspan="2">Late Prehistoric</td></tr>
<tr><td>3000</td><td rowspan="2">Middle pre-historic</td><td>Late</td><td rowspan="3">Plains Archaic</td><td>Late</td><td rowspan="3">Middle Plains Indian</td><td rowspan="3">Middle Pre-historic</td><td>Late</td></tr>
<tr><td>5000</td><td>Early</td><td>Middle</td><td>Middle</td></tr>
<tr><td>7500</td><td colspan="2">Hiatus</td><td>Early</td><td>Early</td></tr>
<tr><td>12000</td><td colspan="2">Early Prehistoric</td><td colspan="2">Paleo-Indian</td><td>Early Plains Indian
Pleistocene Hunters</td><td colspan="2">Paleo-Indian</td></tr>
</table>

3.2.1 The Paleoindian Period (12,500 to 7500 B.P.)

The Paleoindian Period begins during the early Holocene. The Plains were occupied by megafauna such as mammoths, giant sloths, giant bison, and mastodons (Dyck 1983). This period includes known cultures such as Clovis, Goshen, Midland, Folsom, Agate Basin, the Cody Complex, and Terminal Paleoindian complexes. These are all distinguished by a lanceolate projectile point style.

Clovis is the first recognizable archaeological construct on the Northern Plains dating to 11,200 to 10,900 B.P. Clovis is recognized by large projectile points that have a distinct flute and the intentional removal of the end of the basal thinning flake scar from the lateral margins as well as overshot flakes (Bradley 1993:254). Clovis tools were made with very high quality material. The short date range of Clovis suggests that this may have been the spread of an existing technology to existing people rather than a population migration, which supports the evidence for a pre-Clovis population in North America (Beck and Jones 2010:85). Clovis sites include caches, kill sites (arroyo traps and single kill sites), and processing localities (Bradley 1993:253). People used Clovis technology to hunt species such as *Bison antiquus* and mammoth.

There is much debate concerning how Clovis arrived in North America. Theories include an Atlantic migration, a Pacific coastal route, an inland migration route or possibly an *in situ* development. A commonly held theory is the migration of people through an ice-free corridor between the Cordilleran and Laurentide Ice Sheets, though evidence now supports the arrival of people from the west coast or multiple migrations through this ice free corridor. Some research shows that people migrated northward from the south (Elias 2002; Roosevelt et al. 2002) supporting evidence for a Pre-Clovis population. Beck and Jones (2010: 92) found that Clovis sites in the north are younger than those in the south, suggesting a south to north movement, questioning whether Clovis came out of the ice-free corridor.

On the Great Plains other cultures that have been recognized during this period include Goshen, the Western Stemmed Tradition, Midland, and Folsom. Goshen points are basally thinned, not fluted and made using pressure flaking (Frison 1991:45). Folsom and Midland points date to around 10,900 and 10,200 years B.P. Folsom is another fluted projectile point technology with the diagnostic flute extending almost the entire length of the point (Kooyman 2000:111). Bradley (1993:254-255) suggested that Folsom tool makers had a specialized biface manufacturing process and projectile point manufacturing technique. Midland points are very similar to Folsom projectile points but lack fluting (Walker 1999:25).

Folsom appeared rather suddenly and spread rapidly across the landscape. MacDonald (1999) discusses how high mobility would have been necessary for people to find mates and maintain economic, kinship, and social connections. Many of the sites are single or small kill events with no evidence of intensive processing (Bamforth 2001:55). Arroyos continued to be

used to trap and kill bison (Bement 1996:94) with repeated use of the same local. Ritual has been associated with this culture (Bement 1996:92).

Agate Basin occurs from 10,500 to 9,500 years B.P. These projectile points are a lanceolate style that tapers at the base and has no definite shoulder (Kooyman 2000:113). Hell Gap is from a similar time, between 10,000 to 9,500 B.P. These lanceolate projectile points have a distinct shoulder creating a stemmed appearance.

The Cody Complex is comprised of a variety of stemmed projectile point styles. Alberta (9,500 to 9,000 B.P.) points have a short stem and abrupt shoulders. The stem is either parallel-sided or has a slight expanse with basal grinding present. Scottsbluff and Eden projectile points both date to around 8,800 to 8,400 B.P. Eden points lack a prominent stem and often the stem is subtle and created by basal grinding. These points have a distinct diamond cross-section as a result of the collateral or transverse flaking that creates a median ridge (Kooyman 2000:117). The Cody knife which is a distinct asymmetrical biface cutting tool, is also associated with this complex.

At the end of the Paleoindian Period multiple projectile point styles have been identified and termed 'Terminal Paleoindian'. These include Angostura, Lusk, Fredrick, James Allen, Pryor Stemmed, and Lovell Constricted among others. The ages of these projectile points range from 9,900- 7,500 years B.P. (Walker 1999). They are different from the preceding Cody Complex that had point characteristics such as stems some with transverse pressure flaking. Characteristics of these terminal projectile points include being obliquely flaked, parallel-sided lanceolate points, often with concave bases. There is much variation in style in these projectile points. As well they are found across a large geographic region extending from the Northern Plains to the Southern Plains and into the foothills and mountain regions (Kornfeld et al. 2010:94).

Foothill and Mountain Paleoindian Complexes have also been identified beginning around 10,000 B.P. These sites are often in caves and demonstrate a more archaic subsistence. It is hypothesized that there is a difference in subsistence strategies between the Plains and the foothill and mountainous region throughout prehistory (Kornfeld et al. 2010:95). Examples include the Paleoindian occupations at Mummy Cave. The subsistence strategies of these occupations suggest a different strategy than those living on the plains or in the intermontane basins (Frison 1991:69). Medicine Creek Lodge also demonstrates a similar pattern (Frison

1991:69). Husted first suggested this concept based on cave sites located along the Big Horn River (Husted 1969). Husted (1969:86) also favors the interpretation that Pryor Stemmed points may be ancestral to McKean even though a 2,000 year time gap separates these two styles. Pryor Stemmed points are typically found in the Big Horn Mountain region to southwestern Montana (Husted 1969:86).

3.2.2 The Middle Prehistoric Period (7,500 to 2,000 B.P.)

Following the Paleoindian Period is the Middle Prehistoric Period. This period is further subdivided into three sub categories: Early, Middle, and Late Middle Prehistoric (Walker 1992:120). At the end of the Late Paleoindian Period, there was a change in projectile point style from the lanceolate style to a side-notched projectile point style (Kornfeld et al. 2010:106-107), marking the beginning of the Middle Prehistoric Period. This change marks the introduction of a new hunting technology using the atlatl (Frison 1991:79). While hunting with a spear would continue in use, an atlatl allows one to throw a projectile further, faster, and with greater force (Frison 1991).

Bison were still a dominant species throughout the Plains during this period and during difficult times we see heavily processed bone as well as an increase in small animal procurement (Walker 1992). There was also a shift to a broader subsistence pattern from a focus on large game (Frison 1975; Reeves 1973; Schmits 1978). It is also thought that there was an increase in human interaction between the mountainous regions and the plains with people moving in and out of these regions for resources (Hurt 1966; Yansa 2007).

3.2.2.1 The Early Middle Prehistoric Period

The Early Middle Prehistoric Period comprises the Mummy Cave Series that occurred from approximately 7,500 to 4,700 B.P. Five projectile point styles are associated with this series: Mount Albion corner-notched, Gowen, Bitterroot, Hawken, and Blackwater side-notched (Walker 1992). These projectile points are side notched and have either concave, convex, or straight bases. The Mummy Cave Site provides one of the best chronologies of these projectile points (Kornfeld et al. 2010).

The beginning of this period corresponds to very warm and arid climate. It was once argued that the Plains were abandoned during this time (Mulloy 1958). With current research we

now recognize that the Plains were not abandoned and were partially occupied (Walker 1992). Many of the occupations during this period occur along the periphery of the Plains or near oasis-like areas, such as along major waterways. Other reasons attributed to the paucity of Mummy Cave sites include a lack of research in this time period, point misidentification, or archaeological visibility of deeply buried or eroded sites (Artz 1996; Reeves 1973; Sheehan 1995).

3.2.2.2 The Middle Middle Prehistoric Period

The Middle Middle Prehistoric Period occurs from 5,000 to 3,000 B.P. (Walker 1992). There is an increase in the number of sites from this time period demonstrating an increase in human population on the Northern Plains. The Oxbow Complex (4,700-3,800 B.P.) and the McKean Complex (4,200-3,500 B.P.) are both associated with this time period.

Oxbow sites are recognized by a distinct projectile point style as well as the presence of eastern trade goods and a focus on bison procurement and habitation sites (Green 1998:226-230, Kornfeld 1995:305-31, Wettlaufer 1981:79-81). The projectile points have side-notches and a thinned concave base that gives them an eared appearance. Evidence of rich ceremonial practices are suggested by their connections to the Majorville Medicine Wheel, interment practices using red ochre demonstrated at the Gray Site, and dog burials (Calder 1977, Green 1998:225). Oxbow has also been connected with long distance trade routes through the presence of exotic artifacts Green's (1998) re-examination of the Oxbow Site shows that its inhabitants relied on a diverse diet, though general subsistence patterns show that there was a reliance on bison as a major food source.

Walker (1992:128-132) suggests that Oxbow developed on the Northern Plains out of previous grassland adapted complexes. Although initially localized on the Northern Plains, evidence supports a north and eastward movement out of the grasslands into adjacent forested areas during the later Oxbow times (Spurling and Ball 1981:89-102). Webster (2004:82-86) and Morlan (1993:3-84) suggest that this movement reflects incursion of the McKean Complex, which they argue was carried by a migratory population with possible origins in either the Great Basin area or in the Rocky Mountains. Gibson (1981:136) argues that while there is a movement of Oxbow sites to the fringes of the plains to parkland and boreal forest areas, they continue to occupy the plains region. In contrast Wright (1995:302) believes that there was an evolutionary

relationship between these cultures, with Oxbow transitioning into McKean. Similarities between Oxbow and Pelican Lake burials suggest a cultural continuity between the two complexes (Brink 1988:132).

The McKean Complex is most recognizable by distinct projectile point styles: McKean Lanceolate, Duncan, Hanna, and Mallory. The McKean Lanceolate point is a small to medium sized point, lanceolate in shape, has broad shoulders, and an indented base. Duncan projectile points have been described as a straight stemmed form of McKean lanceolate with sloping shoulders (Kornfeld et al. 2010:116). Hanna points have distinct shoulders with an expanding stem (Kornfeld et al. 2010:116). Mallory points are wide, thin, have deep side notches, and have straight, slightly or deeply concave bases (Kornfeld et al. 2010:117). The connection between these points is still unclear as they both co-occur and occur separately. Davis and Keyser (1999) argue that there is a functional relationship between these projectile point styles and that they all belong to the McKean Complex. Mulloy (1954) interprets these points as variations of a single point style. Burials located beneath floors of habitation sites (Brink 1988:132), are not found in the earlier Oxbow Complex. The "increased importance of such stylized features suggests greater investiture of time and effort into habitation features perhaps indicating a greater affinity with particular site locales or areas of resource procurement" (Lamore 2002: 37).

McKean is also noted for a more generalized subsistence strategy based on diverse local resources. There is an increase in plant processing by evidence of roasting pits and grinding slabs found in these sites (Mulloy 1954:452-453; Keyser 1986:225-286; Ramsey 1993:46). McKean sites show much variability across geographic regions, showcasing their adaptability to a variety of environmental variables (Boyd 2000:23-40). The McKean Complex will be discussed in detail in Chapter 4.

3.2.2.3 Late Middle Prehistoric Period

The Pelican Lake Complex (3,600-2,000 B.P.), also known as the Larter Phase in Manitoba (MacNeish 1958), can be identified by two types of projectile point styles. One has a straight base and corner notches with sharp barbs and the other has straight sides, corner notches and a convex base (Dyck 1983). Both types have much variation in size. Sites include campsites and bison pounds. There is a focus on bison for subsistence with faunal remains dominated by bison, though there is a wide variety of smaller mammals and fish (Kevinsen 2013:6). Burial

features associated with Pelican Lake are often shallow subsurface interments in scenic, prominent locations (Brink 1988; Walker 1982). The use of red ochre, as well as inclusion of grave goods with these burials, suggests a belief in an afterlife (Brink 1988:126). Shell gorgets and beads as well as copper have been associated with Pelican Lake sites indicating trade relations with other groups (Hoppa et al. 2005:2255-2257; Walker 1982).

It has been argued that Pelican Lake developed out of the McKean Complex (Reeves 1983), but there are attributes that link this culture more closely with Oxbow than McKean including structure type (Peck 2011:237), subsistence strategy, projectile point form, burial practices, and trade relations (Hoppa et al. 2005:2255-2257; Walker 1982). If this is a cultural continuation from Oxbow then these groups all would have been present on the Plains together throughout the McKean period.

The Sandy Creek Complex occurs between 2,450 and 1,950 BP (Dyck 1983:107-109) and was first identified at the Mortlach site (Wettlaufer 1955). Peck (2011:255 & 275) suggests that Sandy Creek is part of what he calls the Bracken Phase. It is identified by side-notched basally indented projectile points, small to medium in size. Dyck (1983:108-109) notes a similarity in projectile point style to the earlier Oxbow Complex. It is possible that the later northern expression of Oxbow could be the origin of Sandy Creek (Gibson 1981).

Outlook Phase points are lanceolate in shape with low positioned, shallow side-notches and either straight or convex bases (Dyck 1983; Dyck and Morlan 1995). Outlook occupations are thought to represent early Middle Missouri/Plains Woodland ventures on to the Plains (Peck 2011:249). This is supported by the majority of Outlook sites being kill sites, the presence of bone uprights, and preference for KRF as a lithic material, which are all features of the later Besant/Sonota Complexes (Peck 2011:249 Dyck and Morlan 1995:438; Varsakis 2006:100-107).

3.2.3 Late Prehistoric Period

This period is noted by the introduction of pottery and the use of the bow and arrow. Pottery on the Northern Plains first appeared with Besant, being introduced by the Woodland peoples (Meyer and Walde 2009). It has been suggested that the bow and arrow may have been introduced as early as Pelican Lake and late McKean (Dyck and Morlan 1995), but we do not see a wide scale adoption of the technology until the Avonlea Complex (Kevinsen 2013:11).

Besant (2,500-1,400 B.P.) is represented by a lanceolate side-notched projectile point. It can have a straight, convex or concave base with notches that are typically twice as broad as they are deep. Knife River Flint was the dominant material used in the making of these points and it is thought to be traded through the Hopewellian Interaction Sphere. This culture represents the climax of bison procurement (Dyck 1983:113; Frison 1978:223). The people associated with this culture were highly organized in order to take on communal hunting activities such as bison jumps and pounds (Kornfeld et al. 2010:116; Novecosky 1999).

Besant pottery is conoidal in shape, with a grit and sand temper, and formed with the paddle and anvil method (Dyck 1983:115; Walde et al 1995:18). The surface finishing is either cord marked or smooth with a single row of punctates parallel to the rim (Dyck 1983:115; Walde et al. 1995:18). Meyer and Rollans (1990:12) found that much of the Besant pottery is similar to the pottery of the Middle Missouri region. Other materials associated with these sites include perishables such as basketry, cordage, woodworking debris, and digging sticks (Kornfeld et al. 2010:125). During this period people would have used the hide covered tipis and structures reminiscent of the bark or mat covered houses used by Early Woodland cultures (Dyck 1983:113). It is thought that the origin of Besant may be linked either to early forest fringe groups returning to the plains or the Middle Woodland groups in the Middle Missouri Region (Reeves 1983).

The Sonota Complex is thought to be related to Besant (Meyer and Rollans 1990:3), possibly a southern expression of the same culture (Hjermstad 1996; Walde 2006). An increase in ceramics similar to Eastern Woodland pottery as well as the presence of burial mounds distinguishes it from Besant (Hjermstad 1996; Walde 2006). Sonota pottery was formed with paddles wrapped with cord and is conoidal in shape. Exterior finishes are either smooth or cord impressed. Decorations may include a row of punctates, bosses, or an alternating boss and punctate pattern. Dentates or cord impressions may be found on the lip (Meyer and Rollans 1990:1).

Avonlea (1,750 to 1,150 B.P.) was present on the Northern Plains during the same time as Besant. Projectile points are small, side-notched, triangular, and very delicate, with the side notch located close to the base (Dyck 1983:122), ideally suited for the bow and arrow. Local materials were used to make the points. Pottery associated with this culture is generally conoidal or globular in shape. It has a surface finish that is net impressed, spiral channeled, or a smoothed

version of these finishes. Rim decoration can be absent or include one or more rows of punctates (Dyck 1983:123). This culture has a localized pattern with sites being concentrated in southern Alberta and Saskatchewan, and northern Montana (Dyck 1983:123).

Old Women's Phase is associated with the Prairie side-notched (1,200 to 550 B.P.) projectile point. These points are small, triangular, with irregular side-notches positioned close to the basal margin. The pottery is globular, has an angular shoulder, and a constricted neck with straight to expanding rims. The exterior finish is cord-roughened or smooth. Decoration varies among undecorated rims, cord wrapped tool impressions, or punctates (Walker 1999:27).

Mortlach Phase (550-170 B.P.) is associated with the Plains side-notched projectile point. These projectile points are small and triangular with notches positioned higher than the Prairie side-notched. These points have a more refined finish than the Prairie side-notched point. Some sites are associated with European items (Mack 2000). Surface finish on thin walled vessels includes a check-stamped exterior with dentate stamped decoration.

3.2.4 Historic Period

The Historic Period is associated with the arrival of Europeans in North America. This period is also known as the Contact Period (M. Kennedy personal communication 2015). This period is elucidated by written and oral documents of these immigrants with many of the early documents pertaining to the fur trade. With the arrival of Europeans came the eventual disappearance of the bison, the signing of Treaties and the removal of First Nations people to reserve lands. The arrival of Europeans forever changed the Plains. Horses, guns, and other trade items became desirable to Plains people changing traditional hunting, travel, and war practices.

Chapter 4: The McKean Complex

4.1 Introduction

The McKean Complex is an archaeological designation given to the cultural material associated with four projectile point styles named: McKean Lanceolate, Duncan, Hanna, and Mallory. The McKean Complex is synonymous with the Middle Plains Archaic (Middle Middle Prehistoric Period). During this time hunter-gatherer groups utilized a broad-spectrum of resources evident by an increase in stylized roasting pits, cooking features and an increase in groundstone artifacts. The McKean Complex was first recognized during excavations at the McKean site in Wyoming that revealed lanceolate and stemmed points in association with one another (Wheeler 1952) and was later named after this site. Stratigraphically, McKean can often be found below the Pelican Lake Complex and above the Oxbow Complex, though mixing is evident among these cultures at some sites.

Since this the McKean Complex was first identified there has been much discussion as to what to include and exclude in terms of projectile points. Early excavations at sites such as Signal Butte (Nebraska), Pictograph Cave (Montana), and Birdshead Cave (Wyoming) found lanceolate points with concave bases (Bliss 1950; Strong 1935). The McKean site included McKean Lanceolate, Duncan, and Hanna found in direct association (Mulloy 1954). Mulloy (1954) grouped these three projectile points together in one group with three distinct variations while Wheeler (1952; 1954) split them into three separate groups. Today it is generally accepted that these points are a part of the same technological tradition (Davis and Keyser 1999).

The McKean Complex is identified by four different projectile point styles: McKean Lancolate, Duncan, Hanna, and Mallory. The McKean Lanceolate projectile point body is lanceolate in form and has a concave base or basal indentation (Wheeler 1952). The blade edges, or sides, are often parallel and taper towards the tip and can incurve near the base (Syms 1970:125; Wheeler 1952). These points can also have a collateral expanding flake scar pattern giving the point an uneven or sinuous dorsal ridge (Green 1975:163). Duncan projectile points have a lanceolate body form and a hafting element. This point has rounded shoulders and the stemmed haft portion has parallel sides and a concave or indented base. Wheeler (1954:7-8) noted that the shoulders are in-sloping and do not have barbs. This differentiates it from Hanna

projectile points, which have an expanding stem as well as definite shoulders that are straight to in-sloping and are slightly barbed (Syms 1970; Wheeler 1954:7-8). The basal end can vary from concave, to straight, to slightly convex (Brumley 1975; Wheeler 1954). Mallory projectile points are lanceolate in form with a concave or indented base similar to the McKean Lanceolate point. This point has deep and narrow side notches located high on the base of the point (Lobdell 1973). This point is found within a more restricted geographic region, but still culturally related (Ramsay 1993:36). These four projectile points styles are similar morphologically to the lanceolate and stemmed types of the Paleoindian period, but are smaller and lack basal and lateral grinding (Ruebelmann 1982:58).

Davis and Keyser (1999) found that from a local sample the four McKean variants statistically belong to the same technological tradition. Their analysis showed that Duncan and Hanna are the same projectile point style, while the Lanceolate and Mallory points are distinct types, which together make up a multiple weapons system (Davis and Keyser 1999). It is generally accepted that these four projectile points make up a single technological tradition (Frison 1991; Mulloy 1954; Tratebas 1998). Difficulty with this cultural complex arises because there is much point variation, yet continuity over a very large geographic area. It has been found that local traditions can be identified through comparing projectile points through statistical analysis (Keyser and Davis 1999). Local traditions have been identified at the Ken Caryl Ranch sites in Colorado and between the Red Fox and Lightning Spring sites in southern North Dakota and northern South Dakota (Keyser and Davis 1999; Larmore 2002:35).

Ramsay (1993:41) noted variability of the McKean Complex relative to other cultural constructs on the Plains. He found that in addition to projectile point differences, subsistence and resource base varied due to availability in different environmental zones. Another hypothesis is that this variability may represent several groups of people spreading out for prolonged periods of time and similar material culture was maintained through occasional meetings (Brink 1988:61-63). Syms (1969) suggests that the point variation represents stylistic differences that represent different bands cooperating in communal activities.

Names have been given to these local variants of the McKean Complex projectile points which include the Thunder Creek Culture, Whiteshell Focus, the Hayden Valley Sub-phase, the Old Channel Lake Sub-phase and the Larter Focus (Brumley 1975:95 -100; Davis et al. 2012; MacNeish 1958; Wettlaufer 1955). At Danger Cave in northwestern Utah, six varieties of the

McKean type were identified and called W3, W5, W6, W8, W9, and W11 (Jennings 1957). W8 and W9 are McKean Lanceolate variations (Jennings 1957). Syms (1969) would include types W6, W8, and W9 as variations of Wheeler's McKean Lanceolate. Lamore (2002) includes the MM6 type found in Colorado as belonging with the McKean Complex. The Yonkee Complex is also sometimes associated with the McKean Complex. A radiocarbon age from this complex at the Powers-Yonkee site in southern Montana of 4450 +/- 125 B.P. (1-410) was established in the literature although other dates in Wyoming produced much younger dates of less than 3000 B.P. (Frison 1978) suggesting that Yonkee may be associated with the Late Plains Prehistoric (Archaic) Period. Yonkee points also have superficial similarities to the Pelican Lake Complex with regards to projectile point types.

Attributes associated with the McKean Complex include heavily reused flake points, utilized flakes, house pits, small bladelike tools, reoccupation patterns of campsites, the reuse of features and materials, split cobble technology, increases in grinding implements and heating and cooking facilities, the introduction of bison corrals, and the presence of stone circles (Brumley 1975; Frison 1978:51; Frison 1991; Frison and Walker 1984; Keyser 1986; Keyser and Davis 1985; Kornfeld and Frison 1985). Lithic materials are generally locally derived (Peck 2011:211, Syms 1969). Grinding stones, which first appear with terminal Paleoindian cultures, continue throughout the Early Archaic Period and fluoresce during McKean times (Frison 1991:88-91). Earlier periods also are known to have grinding tools, though they are not stylized like the mano and metate associated with the McKean Complex (Frison 1978:352). Prepared or stylized hearths and storage pits are also thought to be more prevalent during this time period (Frison 1991; Wheeler 1985). The importance of these types of features suggests a greater investment of time and effort at certain locals or areas of resource procurement (Larmore 2002:37). The presence of stone circles indicates that there was a change from the Early Plains Archaic use of house pits. The stone circles suggest that there was mobility without a large labour investment at any specific location (Kornfeld 1995:34).

4.2 Subsistence

The subsistence patterns of McKean are quite varied depending on where the site is located and the resources available. Initial reports from the McKean site contained evidence of a sparse faunal assemblage composed of smaller mammals, slab-lined hearths, manos, and metates

(Mulloy 1954). This evidence, as well as supporting evidence from other early sites indicated a reliance on locally available resources (Mulloy 1954; Wheeler 1995b). It also suggested that there was an increased reliance on plant foods and that subsistence practices were similar to those of the Desert Culture found in the Great Basin (Jennings 1957).

Many of the sites contain a variety of large, medium, and small mammals with an increase in procurement of smaller game in some areas (Frison 1991:89). Faunal assemblages that are bison dominated tend to be found in grassland regions (Webster 2004). Bison are not limited to the Plains as they are present in many assemblages though they may be few in number. Bison hunting continues to gain importance during this time and we see the introduction of bison corrals and kill sites in southern Wyoming (Lobdell 1973; Miller 1985). Large animal bones are often crushed or burned indicating the importance of marrow extraction (Hanna and Head 2000; McClelland and Martin 1999; Quigg 1986; Reher et al. 1985; Steege and Paulley 1964; Tratebas 1998).

There was a shift from a non-scheduled hunting and foraging way of life to a scheduled, logistically organized mode of resource exploitation. This is seen through innovations in resource use, storage technologies, and stone tool industries. Storage pits imply long term storage, while marrow extraction suggests production of pemmican produced for long term storage. Caching pits have been found at the McKean site in Wyoming, the Dodge Site in Montana, and possibly at Dead Indian Creek in Wyoming (Davis 1976; Mulloy 1954; Simpson et al. 1984). Peck (2011:223) found evidence that the procurement of bison was primarily by solitary stalking and ambush of small herds in the north, while in the south there was a focus on bison though a wide range of other fauna was also exploited. He found that there was more of a focus on hunting game in the north, while the utilization of plant materials was more prevalent in the south (Peck 2011:223).

Grinding implements and roasting pits become more common during this time period. The use of these implements suggests that there was an increase in the importance of plant foods, or at least in the processing of plants and seeds (Frison 1991; Haberman 1986). Direct evidence for extensive use of plant foods comes from sites that contain seed or plant remains. These sites are shown in Table 4.1. Use of chokecherry and buffalo berry may be related to pemmican production based on ethnographic use. Many plants would not leave behind remains such as shoots, yucca blossoms, prickly pear pads, sego lily roots, wild onion, and prairie turnip

(Haberman 1986). Other plants would have been consumed raw or dried for storage, and some seeds would not preserve. Many edible seeds can be processed for storage by roasting. While some can be eaten raw, other must be ground and or cooked or roasted to be digestible by humans. Specialized roasting pits, platform hearths, and slab-lined hearths were found in the McKean components of the following sites: Pass Creek in Alberta, McKean, Mule Creek and Natrona in Wyoming, Dancing Pants, Bradford House II and Draper Cave in Colorado, Sunday Sage, Kolterman, Harney and Beaver Creek in South Dakota (Brumley 1975; Gilmore et al. 1999; McClelland and Martin 1999; Mulloy 1954; Tratebas 1998; Wheeler 1995a; 1995b). Table 4.1 outlines the floral remains that have been found associated with McKean components. It has also been suggested that manos and metates were used to crush other non-plant materials such as small bones (Frison 1978; Gant and Hurt 1965; Keyser and Davis 1984; Mulloy 1954).

Sites that include manos or grinding metates (grinding slabs) include McKean, Bottleneck Cave, Leigh Cave, Mummy Cave, Mule Creek, Lissolo Cave and Pictography Cave I in Wyoming, LoDaiska, Dipper Gap, 5WL40, Rock Creek and Bayou Gulch in Colorado, George Hey, Lightning Spring, Harney, Landers, Gant, and Kolterman in South Dakota, and Signal Butte in Nebraska (Davis and Keyser 1999; Frison and Huseas 1968; Gant and Hurt 1965; Gilmore et al. 1999; Husted 1962; Keyser and Davis 1985; Mulloy 1954; Ruebelmann 1982; Steege and Paulley 1964; Tratebas 1998; Wedel et al. 1968; Wheeler 1995a; 1995b). There is an absence of milling slabs in the north which suggests differences in subsistence practices from north to south (Brumley 1975; Keyser and Davis 1984; 1985). Plant materials were also used for tool making, including materials such as grasses, yucca leaves, sagebrush bark, juniper bark, willow, birch, Greasewood, and Milkweed (Frison and Huseas 1968; Husted 1978; Keyser 1986) and various wood species for fuel (Keyser 1986).

Table 4.1 Food Plant Remains associated with McKean Complex Sites

Genus/Species	Common Name	Sites	Source
Allum sp.	Wild onion	Leigh Cave	Keyser 1986
Amalanchier alnifolia	Service berry, saskatoon	McKean	Mulloy 1954
Atriplex sp.	Salt bush	George Hey	Keyser 1986
cf. Compositae	Compositae	Redtail, Dancing Pants	Ramsay 1993; Gilmore et al. 1999
cf. Labiatae	Mint family	Redtail	Ramsay 1993
Chenopodium sp./ *Amaranthus* sp.	Goosefoot/pigweed	George Hey, Lightning Spring, McKean, Redtail, Natrona Housepit, Red Canyon Rockshelter, LoDaiska, Spring Gulch, Rock Creek, Dancing Pants	Keyser 1986, Keyser and Davis 1984, Ramsay 1993; Mulloy 1954; Gilmore et al. 1999; Tratebas 1998, McClelland and Martin 1999
Compositae sp.	Domestic sunflower?	Lightning Spring	Keyser and Davis 1984
Cyperaceae sp.	Bulrush	Rock Creek	Gilmore et a. 1999
Fabaceae sp.	Bean	Lightning Spring	Keyser and Davis 1984
Fageceae sp.	Acorns	LoDaiska	Gilmore et a. 1999
Graminae sp.	Grass	George Hey, Lightning Spring, Malin Creek, Dancing Pants	Keyser 1986; Gilmore et al. 1999, Davis et al. 2012
Malvaceae sp.	Mallow	Dancing Pants	Gilmore et a. 1999
Opuntia polyacantha	Prickly pear	McKean, Natrona Housepit, Malin Creek	Mulloy 1954; Davis et al. 2012
Pinus sp.	Limber pine, ponderosa pine, or pine sp.	Leigh Cave, Dancing Pants, McKean	Keyser 1986; Mulloy 1954; Gilmore et al. 1999
Potentilla sp.	Cinquefoil	Redtail	Ramsay 1993
Prunus sp.	Chokecherry pits	Redtail, Leigh Cave	Keyser 1986, Ramsay 1993
Rosa sp.	Wild rose	Redtail, Leigh Cave	Keyser 1986, Ramsay 1993
Rumex sp.	Smartweed	Lightning Spring	Keyser and Davis 1984
Sherperdia argentea	Buffalo berry	Leigh Cave	Keyser 1986
Symphoriapos sp.	snow berry	Redtail	Ramsay 1993
Xanthium sp.	Cocklebur	Rock Creek	Gilmore et a. 1999
	Wild plum pits	Belle Rockshelter	Hughes and Shippee 1948

4.3 Mobility

The appearance of the McKean Complex was quite rapid on the Plains. This complex appeared in the plains and inter-montane basins as well as a continued presence in montane environments. There are more sites recorded compared to the preceding period . The geographic location of sites supports the calculated scheduling of gathering food sources in a wide range of ecological areas. This suggests a highly mobile people travelling between areas of known resources (Frison 1991:88-91). Kelly (1995) explains that mobility is linked to the spatial and temporal occurrence of available resources, the utilization of storage and preservation technology, as well as other variables such as climatic fluctuations, competition for resources, and resource depletion.

The McKean Complex was likely comprised of hunter-gatherers who likely interacted within a band system numbering from 50 – 100 people (Frison 1975). Kelly (1995:211) argues that the optimal group size for hunter-gatherers is 25 without a hierarchy to facilitate coordination. During the warmer part of the year when mobility would be the greatest bands would likely consist of smaller units (extended families) to optimize the exploitation of resources. Aggregations of bands would likely take place during the fall to take advantage of the bison rutting season. These groups would also come together for religious purposes, mating, and sociopolitical reasons (Kelly 1995; Thomas 1983; Weissner 1983). Bands tend to be territorial and develop relationships with certain environments that come from the knowledge of repeated use over time (Larmore 2002). These aggregations are potentially seen archaeologically by the different projectile point variances within a single site (Frison 1991:88-91). It has not been satisfactorily explained whether the large spatial distribution of this complex is due to the spread of a distinct group, a diffusion of technology, or other socio-cultural processes (Keyser and Davis 1985; Tratebas 1998).

There appears to be an increase in preparation with stylized hearths and storage pits with a decrease in labour investment in housing construction compared to the preceding period. This suggests that food preparation and storage were important and that the locations where they occurred were significant and repeatedly reoccupied. The stone circles suggest that there was much more movement throughout the year for resources between known areas of reliable resources, with a more mobile habitation structure. During the Early Plains Archaic there are also stylized hearths and grinding implements present, but the house pits suggest that the people during this time period invested in both the preparation and construction of their housing structures as well as stylized hearths. This difference may be due to the climate and the availability of resources. House pits associated with the McKean Complex can be found at the McKean Site, Dead Indian Creek and Natrona sites in Wyoming and the Red Fox site in North Dakota (Davis and Keyser 1999; Larson 1997; McClelland and Martin 1999; Simpson et al. 1984).

The Early Archaic Period is associated with the Hypsithermal denoted by an arid environment. Investing more time into a habitation structure base camp may have been due to the of scarcity of water and other resources therefore being tied to specific locales. During the Middle Plains Archaic there is a change in the environment to a cooler and moister climate. With

this there would be more abundant resources perhaps suggesting greater mobility. Frison (1991:89) notes that "evidence supports carefully calculated scheduling of economic activities to coincide with food sources in a wide range of ecological areas from season to season". This provides evidence to support a change in mobility practices from the Early to Middle Archaic. The presence of caching implies a scheduled round of movements or moving to known locations with reliable resources at specific times of the year (Davis 1976; Mulloy 1954).

Evidence for a migratory population includes a consistency in projectile points in relation to site variability (Webster 2004:82-86). To maintain this type of homogeneity of projectile point style over such a large area implies much interaction must have taken place including communal gatherings as well as the use of post-marital residence rules to promote continued interaction and reciprocity (Larmore 2002:13). Other activities at communal gatherings may have included kinship renewal, information exchange, hunting, marriage, ritual activities, and pemmican redistribution (Reeves 1996).

Syms (1969) noted that there was a rapid expansion of the McKean Complex though it persisted in the Big Horn region. Webster (2004) found that the oldest sites are located at the headwaters of the Yellowstone River and the Bighorn Basin and then McKean spread into the Black Hills. McKean then was present in modern day southern Saskatchewan and Alberta by around 4200 B.P. likely following a river system (Peck 2011:222-223). Webster (2004) and Morlan (1993) suggest that the people associated with the McKean Complex were a migratory population.

4.4 Origins

Multiple explanations concerning the origins of the McKean Complex have been proposed. The oldest dated McKean sites are located in the Bighorn Mountains in Wyoming. Sites in this area include Sorenson, Granite Creek Rockshelter, Medicine Lodge Creek, Paint Rock V, and Southsider Cave. Ramsay (1993:45) found that the earlier McKean materials have a strong tie to the northern Great Basin though later materials were influenced by the mountain tradition as well as other plains groups. Green (1975) saw strong connections to the Little Lake Series of the Great Basin. Webster (2004:82-86) and Morlan (1993:3-84) suggest that the origins lie in either the Great Basin area or the Rockies. Others argue that McKean originated in the

Rocky Mountains evolving from Plano cultures, then later moved onto the Plains (Benedict and Olson 1973:323-327; Husted 1969:65-67; Keyser and Davis 1984:54-55; Syms 1970:131).

One theory is that the McKean Complex is a manifestation of the Desert Culture (Brumley 1975; Jennings 1964; Wedel 1961). This culture is comprised of archaic hunter gatherers found within the Desert West who had a specialized way of adapting to their desert environment (Jennings 1964:152-153). The Desert Culture is seen as a cultural stage where the diagnostic attribute is the wide exploitation of available species and not an "unvarying complex of archaeological traits or a period of time" (Jennings 1964:152-153). Jennings (1957) proposed that McKean originated from the Desert Culture of the Great Plains and this theory is partially supported by other archaeologists (Brumley 1975; Reeves 1983). Specifically, Reeves (1983) thought the most probable homeland of McKean was the northern and eastern periphery of the Great Basin as well as parts of the Colorado Plateau and Rocky Mountains.

Another theory is that the McKean Complex is derived from the Oxbow Complex (Reeves 1969; Wright 1995:302). These Complexes are sometimes grouped together by some researchers due to many associations between the two Complexes within sites (Gibson 1981:131; Reeves 1973:1236, 1245). One example of this occurred at the Gant Site in South Dakota. One occupation contained both McKean and Oxbow projectile points and produced a radiocarbon age of approximately 4000 BP (Gant and Hurt 1965:48; Gibson 1981:132; Reeves 1973:1240). It is also thought that McKean, Duncan, and Hanna may have developed into the Pelican Lake Complex (Reeves 1970:143-46; 1983).

Husted (1969) hypothesized that the McKean Complex developed from progenitors in high mountain altithermal refuge areas. This is supported by the Fourth of July Site, which is a single component hunting camp in the timberland in the Colorado front range (Benedict 1981). The site dates to approximately 6000 B.P. The projectile points associated with this site are typologically between James Allen and McKean Lanceolate and between Pryor Stemmed and Duncan points. The age of the site, the site location, and the transitional nature of the projectile points support this thesis (Benedict 1981) although high altitude sites often have little stratigraphic integrity increasing the potential for mixed deposits (Walker 2015 personal communication). Husted (1969:98) also noted that all of the archaeological manifestations located in the Bighorn Canyon represented a cultural continuum up to and including the

Shoshoni. Hunting and gathering were the main methods of subsistence in this continuum (Husted 1969).

Husted (1969) outlined the Western Macrotradition. In this model, Agate Basin is split into three branches; the Mountain, Plains, and Basin branches. The Mountains and the Plains branches spread south from the Rocky Mountains into the Western Plains, Great Basin, and the Southwest (Black 1991). The McKean, Pinto, and San Jose point styles represent these three branches. This model is based on the earliest McKean Complex sites located in the Bighorn Mountains. The earlier occupations at the Sorenson Site, the Magnus Site and Bottleneck Cave were considered to be descendants of the Mountain Branch. These occupations contained Agate Basin, Lovell Constricted, and Pryor Mountain stemmed points (Husted 1969:84-91). It was then hypothesized that a population from the east moved into the Rocky Mountains and merged with the Mountain branch following these occupations. This is marked by the appearance of large side notched projectile points in sites like Mummy Cave. It was believed that the McKean Complex was the result of the Plains and Mountain branches coming together and spreading out into the Plains (Husted 1969). This model only works if the early dates with the Pinto and Elko points from Danger Cave and Hogup Cave are discounted (Husted 1999; Husted 2000 in Larmore 2002). Deep side notches, like the Mallory points, are also found at Danger Cave, Utah and are similar to the Pinto Basin points associated with the Archaic traditions of the Great Basin (Lister 1953).

Black (1991) found there was not enough evidence to connect Agate Basin to the mountain-adapted groups and therefore refuted the Western Macrotradition hypothesis. He found ample evidence of the Mountain Tradition in the Southern and Central Rockies as early as 10,000 B.P. Because these dates predate Agate Basin, Agate Basin cannot be a predecessor for the Mountain Tradition. The Mountain Tradition continues uninterrupted in the Southern Rockies for 9000 years with little evidence for the McKean Complex. In the Central Rockies this tradition continues until the arrival of the McKean Complex, around 4500 B.P. (Black 1991).

Tratebas (1998) found a cultural continuum from the early Paleoindian Period to the Late Archaic in the Black Hills with regards to the Early Hunting petroglyph tradition. The changes in the tradition are gradual and do not show significant introductions of new ideas as you would expect with the intrusion of a new people. The petroglyphs in the Black Hills show that this cultural tradition was established about 11,500 years ago (Tratebas 1998). She also notes that this

petroglyph tradition has ties to the west and this technique is found over in the Great Basin and the Southwest. The pecking technique is different than the incised and ground petroglyph traditions found to the east (Tratebas 1998). The panels found in the Black Hills likely reflect a separate cultural entity though similarities suggest that there were cultural ties to the west. This evidence does not support an influx of people onto the Plains, but an *in situ* development (Tratebas 1998). Tratebas (1998) also argues against the McKean origin occurring around the Bighorn Basin and found radiocarbon evidence shows that McKean originated throughout the Plains at the same time.

Other theories include that there were possible eastern woodland influence from the Old Copper or Shield Archaic (Mayer-Oakes 1970:365-369). Reeves (1983) and Syms (1969) also noted possible northern Boreal forest influences. A Plains origin in the Great Basin and Colorado Plateau areas has also been suggested (Green 1975). Benedict and Olson (1973) and Benedict (1981) proposed a Colorado Mountain origin. Husted associated the origin of McKean with the Nesikep Tradition of the northwest (Husted 1969). Green (1975) also found that the Pinto/Humboldt projectile points of the Little Lake series of the Great Basin favorably compare to the McKean projectile points in the northwest and west central Plains.

There are a few sites that have been identified as being precursors to the McKean Complex. The Fourth of July site was previously mentioned. The Savannah Site (24MA1144) is located in the foothills on the north side of Cherry Creek in southwestern Montana. Stratigraphic Zone 10 contained a radiocarbon date of 5560 +/- 110 B.P. associated with Middle Prehistoric period (Archaic) projectile points (Baumler and Eckerle 1999). The date in association with the projectile points indicates that the occupation was Late Early or Early Middle Middle Prehistoric Period. The early date and this similarities in projectile point style lends support to Husted's (1995) suggestion that these are possibly an early variety or precursor to the stemmed Hanna points (Baumler and Eckerle 1999).

4.5 Mortuary and Spiritual Practices

There are few burials associated with the McKean Complex. Burials are generally located under habitation sites and generally have few to no grave goods. Sites that have been identified as having McKean burials include the Crown site, Dead Indian Creek, the Graham site, and the McKean site. There are two burials at the McKean site in Wyoming. The first burial is comprised

of a single human cranium with two bison innominates located in a campsite (Mulloy 1954). There are no grave goods associated with this burial. This burial is thought to be a secondary interment (Mulloy 1954:442). The second burial was comprised of a fragmented cranium, teeth, and fragments of a mandible, scapula, and humerus aged to approximately 5 years (Haspel and Wedel 1985:105-106). This was likely a secondary burial and there were no grave goods. Associated with this burial was a hematite slab and a fragmented deer pelvis (Haspel and Wedel 1985).

The Crown site burial in Saskatchewan was an intact extended burial with no grave goods or red ochre staining, located in a campsite and was dated to 3425 +/- 105 B.P. (S-2291) (Walker 1984). This burial was of a child, aged 2-3 years, found in a shallow pit beneath a Hanna level (Walker 1984). The Graham site in Saskatchewan burial is a cremation within a campsite (Walker 1984) and dated to 3245 +/- 50 BP (S-1574). It is likely the cremation of a bundle burial (Walker 1984:142). The individual, aged 18-20 years, was likely dismembered, implied by a bundle burial, before cremation. Artifacts associated with the burial include a Duncan projectile point, a hafted biface, bifacial preforms, antler tools, a bone tool, and pieces of debitage (Walker 1984:143). At the Dead Indian Creek site in Wyoming, an extended burial in a campsite was uncovered. These were incomplete remains of an immature individual, approximately 9 years in age, located in a shallow pit below an occupation floor (Frison 1978). This was likely a secondary interment due to the small number of scattered elements (Frison and Walker 1984). Radiocarbon dates associated with this burial include 4810 +/- 250 B.P. (W-2597), 4430 +/- 250 B.P. (W-2599), and 3800 +/- 110 B.P. (RL-321) (Frison 1978; Smith 1970).

Mortuary behavior is one line of evidence that suggests the McKean Complex is not a cultural continuity of the Oxbow Complex or a precursor to the Pelican Lake Complex. The sites generally have no grave goods or red ochre, are secondary interments, located in campsites below habitation floors, and the burials were found within shallow pits. There are unfortunately very few know McKean burials creating a very small sample size to provide a comprehensive understanding of these burial practices. The Oxbow mortuary practices generally are isolated away from campsites, associated with red ochre and grave goods, and are primary extended burials. These characteristics are similar to those of the Pelican Lake Complex.

Red ochre was not entirely absent from McKean components. At the Boy Chief site in Alberta, red ochre was rubbed on some of the faunal remains (Head et al. 2003). Ramsay (1993)

found hematite and limonite associated with the McKean levels at the Redtail site in Saskatchewan. Paint palettes were found at Belle Rockshelter in Wyoming (Wheeler 1995b), Bayou Bulch in Colorado (Gilmore et al. 1999), and the Harney Site in South Dakota (Wheeler 1995a). Pigment was uncovered at Bottleneck Cave in Wyoming (Husted 1962). Hematite was found at Quinn Creek in Montana (Rennie and Hughes 1998), LoDaiska in Colorado (Gilmore et al. 1999), Belle Rockshelter in Wyoming (Wheeler 1995b), the Harney site in South Dakota (Wheeler 1995a), and the Landers site in South Dakota (Wheeler 1995a).

The Majorville Medicine Wheel in Alberta is a site of a special nature. It is a medicine wheel comprised of a large central cairn with spokes radiating to the outer ring. McKean projectile points are associated with the central cairn. Other diagnostic projectile points include Oxbow, Pelican Lake, Besant, Avonlea, and Late side-notched (Calder 1977).

Chapter 5: The McKean Complex Sites

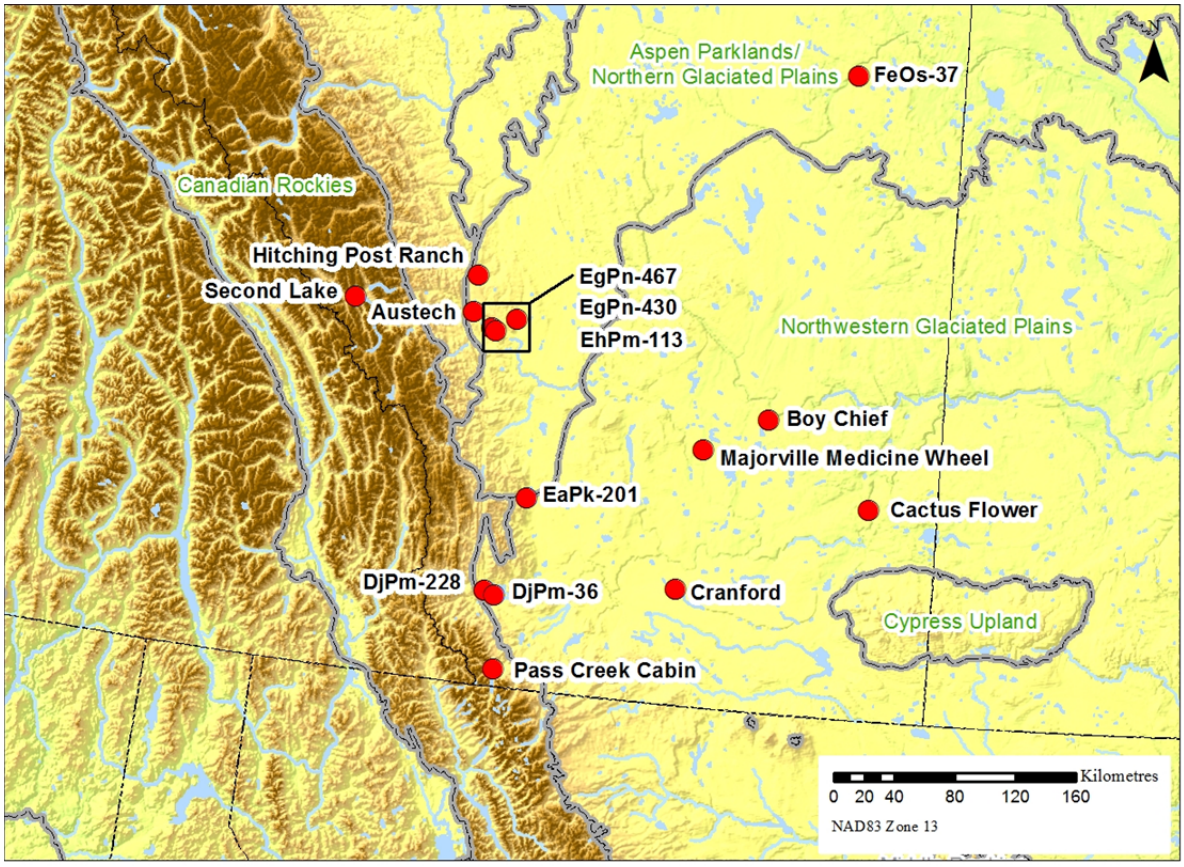
5.1 Introduction

This section contains descriptions of select McKean Complex sites in the study area that form the database used. This list of sites is not comprehensive of all the known sites, but a list of those found with intact levels or occupations associated with a McKean Complex assemblage. There are many more McKean sites than those listed. For example, in Saskatchewan, as of 2012, there were 775 known McKean Complex sites (ARMS 2012). Many of these are single artifact finds or surface scatters. Artifact finds associated with the McKean Complex are comprised of a single diagnostic McKean projectile point. Artifact scatters contains more than one artifact. Scatters associated with the McKean Complex will contain at least one diagnostic McKean projectile point though others may be present. These types of sites are not able to be radiocarbon dated and do not provide any stratigraphic control over the associated McKean artifacts, therefore they are not used in this analysis and will not be described in this chapter. The sites described in this chapter provide some stratigraphic context to better understand the McKean occupations at a site. This chapter provides a general overview of the sites, organized by state or province and the ecoregion (level 3) in which they are found. Further comparative analysis of the sites in the study area will be examined in Chapters 6 and 7.

5.2 McKean Sites in Alberta

5.2.1 Introduction

Alberta sites examined in this thesis are in three ecoregions: the Canadian Rockies, the Aspen Parklands/Northern Glaciated Plains, and the Northwestern Glaciated Plains. Ages for the McKean occupation in this province ranges from 4220 – 2840 B.P. McKean Lanceolate points occur from 4220 – 3330 B.P., Duncan from 4220 – 3330 B.P., and Hanna from 4220 – 2880 B.P. All three types are present by 4220 B.P., though Hanna may persists longer, until 2880 B.P. Sites are older in the southeastern part of the province and get younger to the northwest.



(Brumley 1975; Calder 1977; Fedje 1986; Hanna and Head 2000; Head et al. 2003; Hjermstad 1998; Morlan n.d.; Reeves 1972; Stuart 1990; Van Dyke 1993; Van Dyke 1994; Vivian et al. 2005; Wilson 1983)

Figure 5.1 Alberta Sites Associated with the McKean Complex

Peck (2011) noted that McKean Complex surface finds are common south of the North Saskatchewan River in Alberta. Lithic material in these sites was mostly local though some exotics are present (Peck 2011:216). A medicine wheel and red ochre, suggesting a spiritual significance, are associated with this Complex. Of the sites discussed in this thesis most are along major waterways or their tributaries. Many of the sites contained multiple components or were interpreted as having multiple occupations demonstrating the repeated use of these sites before, during, and after McKean time. Features include basin hearths, earth pits, surface pits, stone boiling pits. The Cranford site contains stone circles. A cobble platform was found at EaPk-201 and a stone platform hearth at Pass Creek Cabin. Faunal collections are dominated by bison, but many sites also contain remains of medium to small fauna. No paleobotanical studies were conducted for these sites. Site types include campsites, processing sites, kill sites, and a

medicine wheel. Table 5.1 includes the known radiocarbon ages for McKean components in Alberta.

Table 5.1 Radiocarbon Ages of Alberta McKean Components

Site Name	Site #	Context	Associated Points	Date B.P.	Material	Lab No.	Source
	EaPk-201	West block, CU-2	H	3720 +/- 260	Bone	S-3984	Brumley 1975; Morlan n.d.
	EaPk-201	West block, CU-3	H	3860 +/- 320	Bone	S-3985	Brumley 1975; Morlan n.d.
	EgPn-430	Area 2	H/L, mixed	3580 +/- 70	Bone	BETA-126647	Vivian et al 2005
	EgPn-467	Upper component	D/H/L	3330 +/- 90	Bone	BETA1151	Hanna and Head 2000
	Ehpm-113	Horizon 2	H	2880 +/- 40	Bone	BETA2361	Malasiu 2007
	EiPo-51	Single component	H	3680 +/- 75	Bone	BETA-1672	Wilson 1983; Morlan n.d.
Austech	EhPo-55	30-60 cm	H/L	3400 +/- 60	Bone	AECV155C	Van Dyke 1993
Austech	EhPo-55	30-60 cm	H/L	3540 +/- 60	Bone	AECV134C	Van Dyke 1993
Boy Chief	EeOv-68	B4, Occ. 3	H	3360 +/- 80	Bone	AECV2024	Head et al. 2003
Boy Chief	EeOv-68	B4, Occ. 3	H	3400 +/- 90	Bone	AECV2053	Head et al. 2003
Cactus Flower	EbOp-16	Occupation IIIV	D/H/L	4220 +/- 130	Charcoal	S-1210	Brumley 1975; Morlan n.d.
Cactus Flower	EbOp-16	Occupation IIIV	D/H/L	4130 +/- 85	Charcoal	S-782	Brumley 1975; Morlan n.d.
Cactus Flower	EbOp-16	Occupation VI	D/H	3970 +/- 160	Bone	S-820	Brumley 1975; Morlan n.d.
Cactus Flower	EbOp-16	Occupation VI	D/H	3615 +/- 95	Charcoal	S-823	Brumley 1975; Morlan n.d.
Cactus Flower	EbOp-16	Occupation LIV	D/H/L	3705 +/- 80	Bone	S-784	Brumley 1975; Morlan n.d.
Cactus Flower	EbOp-16	Occupation LIV	D/H/L	3620 +/- 95	Charcoal	S-822	Brumley 1975; Morlan n.d.
Cactus Flower	EbOp-16	Occupation LIII	D/H	3930 +/- 110	Charcoal	S-1013	Brumley 1975; Morlan n.d.
Pass Creek Cabin	DgPl-1	Occupation 1C	L, mixed	3860 +/- 215	Apatite	GX-1460	Brumley 1975; Morlan n.d.
Second Lake	EhPv-58	Occupation 6	H	3560 +/- 135	Charcoal	S-2778	Fedje 1986
Second Lake	EhPv-58	Occupation 6	H	2540 +/- 120	Bone	S-2754	Fedje 1986
Snyder Farm Locality	DjPm-36	100-120 cm BS	H, mixed	3670 +/- 130	Bone	AECV-1190C	Van Dyke 1994

Legend: H = Hanna, D = Duncan, L = McKean Lanceolate, mixed = other cultural association

5.2.2 Description of Sites

5.2.2.1 Sites in the Canadian Rockies

The Second Lake site (EhPv-58) is a multicomponent site located on the northwestern edge of Second Lake (Fedje 1986:48). This site contains ten occupations with cultural associations including McKean, Pelican Lake, and the Bracken Phase (Peck 2011). Hanna-like points were found in Occupation 6. Artifacts include lithic artifacts and projectile points. Faunal remains include bison, deer, and beaver. Radiocarbon ages for occupation include 3560 B.P. and 2450 B.P., though the earlier date is considered intrusive (Fedje 1986). No floral remains were reported.

Pass Creek Cabin (DgPl-1) is a campsite and a kill site on the south side of Pass Creek Valley. The campsite occupations include IA (Lusk), IB (Bitterroot and Salmon River points), IC (McKean), and in the disturbed level above McKean, Late side-notched material was found. The McKean component (1C) contains McKean Lanceolate points. Side-notched points are considered intrusive from the overlying level due to rodent disturbance (Peck 2011:208). Features include a surface hearth, a stone platform hearth, and possible cairn (Reeves 1972:56-57). FCR was also uncovered. A radiocarbon age of 3890 B.P. was obtained for this component (Reeves 1972). No floral remains were reported.

5.2.2.2 Sites in the Aspen Parkland/Northern Glaciated Plains

EgPn-430 is a multicomponent processing campsite and bison kill on the northwest slope of the West Paskapoo Escarpment. Projectile points from the processing area in Area Two include McKean Lanceolate, Hanna, Pelican Lake, Late side-notched and non-diagnostic points. Tools include bifaces, endscrapers, wedges, retouched flakes, utilized flakes, cores, a drill a graver, a chopper, a bone hammer and bone awls (Vivian et al. 2005:26). Faunal remains included bison, wolf, fox, wapiti, rabbit, and bivalves. FCR was also found at the site. A radiocarbon age of 3580 B.P. was obtained for the bone in the McKean level (Vivian et al. 2005:46-47). No floral remains were reported.

EgPn-467 is a multicomponent site that occurs in hummocky terrain above the Bow River. This site was interpreted as a late winter base camp comprising of two McKean

components. The lower component contains a Hanna projectile point base. Artifacts include a biface, a side scraper, retouched flakes, a utilized flake, a core, hammerstones, flakes, and shatter. Faunal remains included highly fragmented bison. The upper component produced an Oxbow, Hanna, Duncan, and a possible McKean Lanceolate point. Artifacts include bifaces, scrapers, flake tools, cores, hammerstones, and debitage. A radiocarbon age of 3330 B.P. was obtained (Hanna and Head 2000:155). It is thought that this site represents many occupations over long periods of time, likely by a single cultural group (Hanna and Head 2000:155). No floral remains were reported.

Hitching Post Ranch (EiPo-51) is described as a bison assemblage in the foothills northwest of Calgary (Wilson 1983:110). The faunal remains include bison, goose-sized bird, duck, sandpiper, snowshoe hare, rodent, ground squirrel, wolf or dog, white tailed deer, wapiti, and moose. The large number and range in age of the bison suggest a catastrophic die off instead of a hunting excursion. Artifacts included Hanna points, flakes, antler hammer, an antler punch, an antler wedge, and a dentalium bead. A radiocarbon age of 3680 B.P. was obtained (Wilson 1983). No floral remains were reported.

The Austech site (EhPo-55) is a butchering area on a terrace of the Bow River (Van Dyke 1993). In the south block, a McKean Lanceolate and Hanna point were found in association with a layer of bone. Artifacts included a retouched flake and heavily chipped tools. Faunal remains included bison. There were no features, but FCR was found (Van Dyke 1993). No floral remains were reported.

EhPm-113 is a multicomponent kill and processing site on an upper valley bench above Beddington Creek (Malasiuk 2007:6-55). Horizon 2 contains the base of a Hanna point and Horizon 3 a complete Hanna point. A radiocarbon age of 2880 B.P. from Horizon 2 was obtained. There was a lack of clear stratigraphy as well as rodent disturbance (Malasiuk 2007). No floral remains were reported.

EaPk-201 is a multicomponent site on a flood plain terrace of Willow Creek (Hjermstad 1998:76). This site is at the confluence of the three Ecoregions: the Canadian Rockies, the Aspen Parkland/Northern Glaciated Plains, and the Northwest Glaciated Plains. Three components were identified. Level CU-2 in the west block produced a possible Hanna point. CU-2, a secondary butchering area, contained features including a basin hearth and a cobble platform. Artifacts include a t-butt drill, end scraper, and debitage. Faunal remains include bison, canid, and bird

remains. CU-3 contains a Hanna point and is interpreted as an early winter campsite and bison processing area. Artifacts include endscrapers, and a utilized flake. Faunal remains include bison, deer, dog, and wolf. A radiocarbon age of 3860 B.P. was obtained for this component (Hjermstad 1998). No floral remains were reported.

5.2.2.3 Sites in the Northwestern Glaciated Plains

Snyder Farm Locality (DjPm-36) is a site at the confluence of the Crowsnest River and the North fork of the Oldman River. It contains three occupations, Gowen, Hanna, and Pelican Lake. A metal point was also found in the field at the site (Van Dyke 1994:116). The Hanna occupation occurs between 100 and 120 cm BS. Artifacts associated with this occupation include a projectile point, a biface, an elongated pebble, cores, retouched flakes and debitage. No features were recorded and the faunal remains are fragmentary (Van Dyke 1994:128). The radiocarbon age was taken for the overlying level; the age retrieved was 3670 B.P. (Van Dyke 1994). No floral remains were reported.

The Cranford site (DlPb-2) is a habitation site on a terrace above the Oldman River. There are 35 stone circles and six buried components (Stuart 1990:3). One of the stone circles is associated with a McKean diagnostic projectile point (Webster 2004:60). An intact McKean activity area was located beneath the stone circle. Artifacts include McKean lanceolate points, a biface, scrapers, modified flakes, choppers, hammerstones, and flakes (Stuart 1990:85). Flaked tools were made from both local and exotic materials. Faunal remains include bison. Activities seem to cluster around a surface hearth and include meal preparation, possibly meat processing, and tool manufacturing (Stuart 1990). No floral remains were reported.

The Majorville Medicine Wheel (EdPc-1) is located on a high hill on the southern bank of the Bow River. The wheel is comprised of a large central cairn surrounded by a circle of stone. Twenty-eight spokes radiate from the cairn to the outer ring (Calder 1977). An excavation of the cairn revealed sixteen layers with associated artifacts in all of them. A total of 254 diagnostic projectile points were recovered including Late side-notched, Avonlea, Besant, Pelican Lake, McKean Complex, and Oxbow. Many projectile points were found in all the layers, but there seems to be a general change throughout time, utilizing a common feature, supporting a long continuity of similar belief systems (Calder 1977:30-37). There was extensive rodent burrowing

throughout the cairn, therefore, much of the original context may have been lost making the interpretive value of the data questionable.

Cactus Flower (EbOp-16) is a multicomponent site above the South Saskatchewan River. This campsite is thought to be repeatedly used either as a single family or a small number of family groups. The site is well situated for ambushing animals getting water. There are a total of 10 occupations, most associated with the McKean Complex, and the site was eventually abandoned after Pelican Lake. Occupation IX contained a McKean Lanceolate point. Artifacts included bifaces, retouched flakes, end scrapers, a graver, pebble cores, chipped tools, a hammerstone, and a shell bead was also recovered. Features included basin hearths. Faunal remains included bison, antelope, cottontail rabbit, and freshwater clams. Occupation VIII has McKean Lanceolate, Duncan, and Hanna points. Tools included bifaces, retouched tools, end scrapers, spokeshaves, a graver, pebble cores, chipped tools, hammerstones, anvil stones, and bone awls. A ground stone pipe, bone bead, polished bone fragments, and an ammonite septum were also found. Faunal remains include bison, antelope, dogs, kit fox, cottontail rabbit, jackrabbit, bird and fish. Features included basin hearths, an earth pit, and a possible structure. Radiocarbon ages of 4130 B.P. and 4220 B.P. were established for this level (Brumley 1975).

Occupation VII contains Duncan points. Other artifacts include bifaces, retouched flakes, endscrapers, a graver and pebble cores. Faunal remains include bison, cottontail rabbit, birds, and a freshwater clam. Features included basin hearths, surface hearths, an earthen pit, and ash concentrations. Occupation VI contained Duncan and Hanna points as well as point fragments. Artifacts include bifaces, retouched flakes, endscrapers, a graver, pebble cores, chipped tools, an anvil, antler tine fragments, a bone blunt end tool, and a ground stone disk. Faunal remains include bison, antelope, mule deer, dog, and freshwater clam. Radiocarbon ages for this occupation include 3600 B.P. and 3900 B.P. (Brumley 1975).

Occupation V is associated with a Duncan point. Other artifacts include a biface, retouched flakes, end scrapers, chipped tools, a bone awl and a circular polished stone. Faunal remains include bison and a bird. Occupation IV contains a McKean Lanceolate, Duncan, a Hanna point, as well as fragmentary points. Other artifacts include bifaces, retouched flakes, endscrapers, spokeshaves, pebble cores, chipped tools, bone awls, and a shell bead and bone bead. Faunal remains include bison, antelope, dog, and freshwater clam. A radiocarbon age of 3600 B.P. was obtained. Occupation III contains a Duncan, Hanna, and fragmentary projectile

points. Other artifacts include retouched flakes and chipped tools. Faunal remains include a bison. Features included a basin hearth, earth pits, and surface pits. A radiocarbon age of 3900 B.P. was obtained but is rejected because it is out of sequence with the other dates (Brumley 1975). No floral remains were reported in any of the occupations.

The Boy Chief site (EeOv-68), or Saahkomaapiina, is a multicomponent site on a terrace on a tributary of the Red Deer River. Projectile points from Bitterroot, Early Prehistoric, Oxbow, McKean, and Pelican Lake are associated with this site. Block 4, Occupation 3 is a McKean component, identified by Hanna points, an unidentified point and a small hearth (Head et al. 2003:135-42). Artifacts include modified flakes, an endscraper, and a bipolar core. Faunal remains include bison, three bones had red ochre rubbed on them. Radiocarbon ages include 3400 B.P. and 3360 B.P. Fire broken rock (FBR) was present and fracturing patterns suggest their use was stone boiling (Head et al. 2003). No floral remains were reported.

5.3 McKean Sites in Saskatchewan

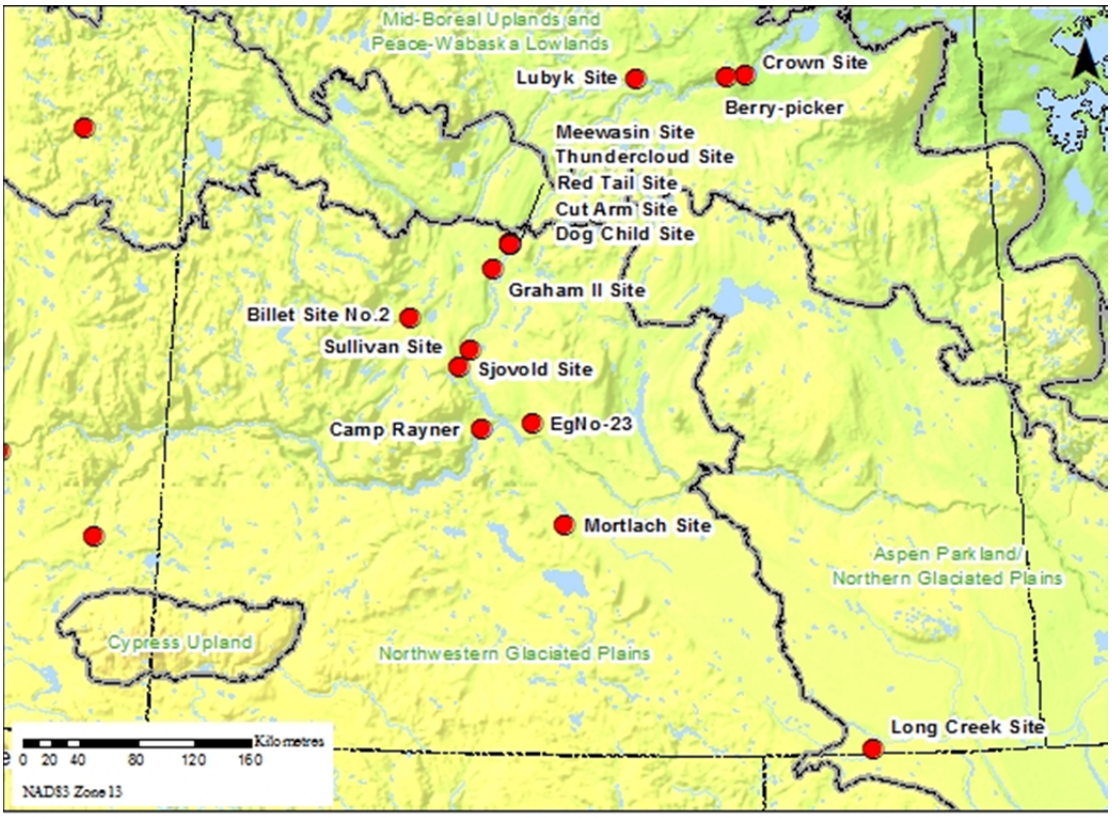
5.3.1 Introduction

Within Saskatchewan the sites examined are located within three ecoregions: the Northwestern Glaciated Plains, the Aspen Parkland/Northern Glaciated Plains, and the Mid-Boreal Uplands and Peace-Wabaska Lowlands. McKean sites are also be found in the Mid-Boreal Lowlands and Interlake Plain as well as the Cypress Uplands, many of which are surface scatters or single projectile points which will not be examined in this thesis . McKean sites in Saskatchewan date from approximately 4330 -3100 B.P.

McKean Lanceolate points occur from 4330 – 3150 B.P., Duncan from 3460 – 3150 B.P., and Hanna from 3660 – 3100 B.P. McKean Lanceolate projectile points occur continuously through this time period which Duncan and Hanna appear much later, especially in comparison to sites located in south-central Alberta. The oldest sites are located in the central part of the province. Sites within Wanuskewin Heritage Park, the Crown site, and EgNo-23 contains some of the youngest and oldest radiocarbon ages.

Subsistence focuses on bison though other species are present. Sites are generally located in a dune location or near a major watersource. Features include surface hearths, basin shaped hearths, rock and lithic concentrations, stone boiling pits, and burials. Reported floral remains

are rare, though they were uncovered at the Red Tail site (Ramsay 1993). Site types include habitation sites, campsites, burials, processing sites, and kill sites. Lithic materials were often local though Knife River Flint is present at some sites. Sites are often located near major watersources.



(Cahill 2012; CEC 2011; Dyck 1983; Dyck and Morlan 1995; ESRI 2008; Finnigan et al. 1983; Frary 2009; Frey 1997; Johnson 1975; Pletz 2010; Quigg 1986; Ramsay 1993; Smith 2012; Walker 1984; Webster 1999; 2004; Wettlaufer 1956; Wettlaufer & Meyer-Oakes 1960)

Figure 5.2 Saskatchewan Sites Associated with the McKean Complex

Table 5.2 Radiocarbon Ages of Saskatchewan McKean Components

Site Name	Site #	Context	Associated Points	Date B.P.	Material	Lab No.	Source
	EgNo-23	Occupation 2a	H	3348 +/- 50	Bone	BGS-2363	Webster 2004
	EgNo-23	Occupation 2b	H	3430 +/- 40	Bone	Beta16731	Webster 2004
	EgNo-23	Level 2	H	3440 +/- 55	Bone	BGS-2364	Webster 2004
	EgNo-23	Level 3	L	4140 +/- 60	Bone	Beta18352	Webster 2004
Billett Site No. 2	EkNv-36	Area o-3	H	3100 +/- 60	Bone	S-2054	Dyck 1983
Billett Site No. 2	EkNv-36	Area o-2	H	3470 +/- 120	Charcoal	S-2063	Dyck 1983
Crown site	FhNa-86	East	L	3825 +/- 90	Bone	S-2369	Quigg 1986
Crown site	FhNa-86	West	L	4180 +/- 115	Bone	S-2290	Quigg 1986
Crown site	FhNa-86	Hab b/L4e	H	3330 +/- 110	Bone	S-2292	Quigg 1986
Crown site	FhNa-86	Hab b/L6e	H	3600 +/- 80	Bone	S-2291	Quigg 1986
Crown site	FhNa-86	Hab b/L6e	H	3425 +/- 105	Bone	S-2554	Quigg 1986
Crown site	FhNa-86	Hab b/L3w	H	3605 +/- 120	Bone	S-2556	Quigg 1986
Crown site	FhNa-86	East	L	4330 +/- 115	Bone	S-2520	Quigg 1986
Crown site	FhNa-86	East	L	3825 +/- 75	Bone	S-2521	Quigg 1986
Crown site	FhNa-86	West	L	4295 +/- 85	Bone	S-2525	Quigg 1986
Crown site	FhNa-86	Level 8, east	L	3995 +/- 80	Bone	S-22526	Quigg 1986
Cut Arm site	FhNa-86	Leve 8, upper	L	3387 +/- 50	Bone	BGS-238	Webster 2004
Cut Arm site	FhNa-86	Level 8, lower	L	3448 +/- 60	Bone	BGS-2384	Webster 2004
Dog Child	FbNp-24	Level 2a	D/H/L	3460 +/- 45	Bone	BGS-2660	Pletz 2010
Graham II	FaNq-30	Burial	D/H/L	3245 +/- 50	Bone	S-1574	Walker 1984
Long Creek site	DgMr-1	Level 5	H	3370 +/- 145	Charcoal	S-63a	Wettlaufer & Meyer-Oakes 1960
Long Creek site	DgMr-1	Level 5	H	3375 +/- 55	Bone	BGS-2362	Webster 2004
Mortlach	EcNl-1		D	3400 +/- 200	Bone	S-2	Wettlaufer 1956
Red Tail site	FbNp-10	11	H	3580 +/- 80	Bone	S-3372	Ramsay 1993
Red Tail site	FbNp-10	12(1)	H	3470 +/- 80	Bone	S-3373	Ramsay 1993
Red Tail site	FbNp-10	12(2)	H	3660 +/- 75	Bone	S-3008	Ramsay 1993
Red Tail site	FbNp-10	13(2)	L	3860 +/- 70	Bone	S-3374	Ramsay 1993
Red Tail site	FbNp-10	13(2)	L	3880 +/- 70	Bone	S-3375	Ramsay 1993
Red Tail site	FbNp-10	13(4)	L	4280 +/- 80	Bone	S-3009	Ramsay 1993
Sjovold site	EiNs-4	Layer XXI	H	3530 +/- 115	Bone	S-2062	Dyck and Morlan 1995
Thundercloud site	FbNp-25	5a	D/H/L	3150 +/- 50	Bone	BGS-2369	Webster 2004
Thundercloud site	FbNp-25	5b	D/H/L	3315 +/- 50	Bone	BGS-2367	Webster 2004
Thundercloud site	FbNp-25	5c	L	4040 +/- 90	Bone	BGS-3645	Webster 1999

Legend: H = Hanna, D = Duncan, L = McKean Lanceolate

5.3.2 Description of Sites

5.3.2.1 Sites in the Northwestern Glaciated Plains

The Billett site (EkNv-36) is located near Harris in a cultivated sand dune. Many artifacts have been found at the surface including scrapers, a uniface, a core, and debitage. Testing produced two hearths with Hanna points as well as varieties of Middle and Late Period projectile points including Avonlea, Pelican Lake, McKean, and Oxbow. Two radiocarbon ages are associated with the hearths: 3100 B.P. and 3465 B.P. (Dyck 1983). No floral remains were reported.

The Graham site (FaNq-30) is an intentional cremation burial within a habitation floor south of Saskatoon. The fill in the hearth contained a large number of burned and calcined bone fragments, many of which were human. The remains were likely a male older than 18-20 years of age. Walker (1984:142) suggests that the remains represent the cremation of a bundle burial. Associated with a circular stained area was a Duncan point, bifacial items, a core fragment, debitage, and antler and bone awls. Lithic tools were made from local materials. A radiocarbon age of 3350 B.P. was determined for the remains (Walker 1984:140-142). No floral remains were reported.

The Mortlach site (EcNl-1) is a multicomponent campsite in the Besant Valley. In Zone 8 Duncan/Hanna points were uncovered with these points originally associated with the "Thunder Creek Culture". Dyck (1983:101) re-identified these as part of the McKean Complex. Scrapers, preforms, and choppers were uncovered and many are made of local materials. No faunal remains were described. A radiocarbon age of 3400 B.P. was retrieved from this level (Wettlaufer 1955:81; Morlan n.d.). This site represents a temporary camp for a small group of hunters (Wettlaufer 1955). No floral remains were reported.

The Sjovold site (EiNs-4) is a multicomponent campsite near Outlook on the South Saskatchewan River. This site has 21 observed occupations. Projectile points found at this site include Late side-notched, Prairie side-notched, Avonlea, Samantha, Besant, Pelican Lake, Bratton, Outlook, and McKean. The McKean Complex component is Layer XXI, which is associated with a Hanna projectile point (Dyck and Morlan 1995). A radiocarbon age of 3610 B.P. was obtained from this level. Artifacts include a bifacial knife, a prefor, m, a projectile point, and a hammerstone. Faunal remains include bison, deer or pronghorn, and meadow vole (non-

cultural). Features include shallow hearths or dump areas (Dyck and Morlan 1995:523-527). It is suggested that this layer represents a disposal area on the periphery of a larger campsite. Cultural activities include processing of animals (Dyck and Morlan 1995). No floral remains were reported.

The Redtail site (FbNp-10) is a multicomponent habitation site on the South Saskatchewan River in Wanuskewan Heritage Park. The site was likely occupied by small groups reoccupying the same site over generations (Ramsay 1993:294). The upper occupations produced Avonlea and Besant occupations. The McKean occupations were recognized in layers 11, 12, and 13 (Ramsay 1993:12). The McKean levels contain hematite and limonite. Ramsay (1993) includes layers 8 through 10 as McKean occupations though there were no diagnostics. Layer 8 contains a house pit similar to those associated with the Middle Archaic Period in Wyoming (Webster 2004:20). Six radiocarbon ages are associated with layers 11-13 ranging from 3390 – 3950 B.P. (Ramsay 1993).

Layer 11 artifacts included a Hanna projectile point, a graver, cores, FBR, debitage, flakes, shatter, an ovate biface, unifaces, an anvil, culturally modified bone, a unifacial perforator tool, and smoothed stone. Faunal remains include bison, deer, canid, mustelid, toad or frog, shell, and rodent bones. Features include a basin hearth, charcoal concentrations, a surface hearth, a bison skull, and hearths. Floral remains include *Chenopodium* sp., *Prunus* sp., *Rosa* sp., *Symphoriarpos* sp. (seed and berries), cf. *Compositae*, cf. *Labiatae*, cf. bud, and unidentified seeds (Ramsay 1993).

Layer 12 is identified as a winter occupation. Layer 12 artifacts included Hanna, Duncan, and stem and side-notched projectile points, FBR, debitage, a utilized flake, shatter, a chopper, hafted pointed bifaces, unifaces, marginally retouched tool, a hammerstone, an anvil, a chopper, and culturally modified bone. Faunal remains include bison, canid, lagomorph, fish, toad or frog, shell, reptile, and rodent bones. Features included pits, charcoal concentrations, and hearths. Floral remains include *Chenopodium* sp., and unidentified seeds (Ramsay 1993).

Layer 13 is identified as a winter occupation. Layer 13 artifacts include Duncan and McKean Lanceolate projectile points, FBR, debitage, flakes, shatter, bipolar core, pointed bifaces, unifaces, endscraper, perforator/graver, marginally retouched stone tool, a grooved abrader, a chopper, a hammerstone, and culturally modified bone. Faunal remains include bison, canid, mustelid, lagomorph, avian, toad or frog, and rodent bones. Features include hearths,

charcoal concentrations, a surface hearth, a pit, and a hearth with ash. Floral remains include *Chenopodium* sp., *Potentilla* sp., *Prunus* sp., *Rosa* sp., cf. *Iva* sp., nut shell, and unidentified seeds (Ramsay 1993).

The Thundercloud site (FbNp-25) is a multicomponent site along Opimihaw Creek in Wanuskewin Heritage Park. This site contains Oxbow, McKean, Pelican Lake, Avonlea, Prairie and Plains side-notch and Historic occupations. Occupation level 5 represents three occupations 5a, 5b, and 5c. These occupations were associated with the McKean Complex and interpreted as a secondary processing site for bison and initial processing of medium to small mammals, birds, and rodents. Artifacts include projectile points, knives, perforators, bifacial fragments, endscrapers, cores, debitage, FCR, bone tools, and unifacial fragments. Projectile points include McKean Lanceolate, Duncan, and Hanna. Features include hearths, organic stains, and a cluster of bone fragments. Faunal remains include bison, rabbit, grouse, canid, rodents, birds, badger, skunk, toad, and clam (Mack 2000:196). Radiocarbon dates were taken at level 5a, 5b, and 5c and aged to approximately 3150 B.P., 3315 B.P., and 4040 B.P. (Mack 2000). No floral remains were reported.

The Cut Arm site (FbNp-22) is a multicomponent habitation site near the mouth of Opimihaw Creek in a gently sloping drainage in Wanuskewan Heritage Park. A total of 15 occupation levels were identified including Contact, Plains side-notched, Besant, McKean, and Oxbow. Occupation 8 is associated with the McKean Complex. The upper occupation of Level 8 is associated with a McKean Lanceolate projectile point. Other artifacts include debitage, an endscraper, a cobble, a spokeshave, and FCR. Faunal remains include bison, very large mammal, large mammal, and small mammal. Features include artifact concentrations and a charcoal stain. This level in interpreted as a processing locale. The upper occupation of this level produced a radiocarbon age of 3387 B.P. and the lower occupation to 3448 B.P. (Smith 2012:143-155). No floral remains were reported.

The Meewasin site (FbNp-22) is a multicomponent site in Wanuskewin Heritage Park within a deep drainage basin on the shore of the South Saskatchewan River (Frary 2009:5). This site contains seven distinct occupations including Avonlea, Pelican Lake, Sandy Creek, and McKean occupations. Cultural Level 5 (A and B) are associated with the McKean Complex and show evidence of hide processing activities. Level C5A was identified by a Duncan projectile point. Artifacts include projectile points, a hammerstone, an endscraper, and end-sidescraper, a

retouched flake, a utilized flake, cores, debitage, FCR, and a large hafted biface. Faunal remains include bison, order artiodactyla, class mammalia, and unidentified bone. Features include a black organic stain and a possible hearth. A radiocarbon age was taken from C5B of 4120 B.P. (Frary 2009:100-111). Level 4 contains a possible poorly made McKean projectile point as well as a Pelican Lake point (Frary 2009). No floral remains were reported.

EgNo-23 is a multicomponent site north of the Douglas Park Sandhills in southcentral Saskatchewan. It is composed of seven occupations, three of which are McKean (2a, 2b, and 3) (Webster 2004). Other occupations include Besant and Pelican Lake (Neal 2006). Level 2a and 2b occupations were analyzed as a single unit as stratigraphic separation was not always evident. Cultural Level 2 contains Duncan-Hanna and Pelican Lake projectile points. It is believed that the stratigraphic position of the Pelican Lake point is associated with occupation 1c. Other artifacts from this level include a bifacial preform, bifacial fragments, retouched lithics, a uniface, debitage, and a wedge. Features include a stone boiling pit, an organic stain, a large flake concentration, and a cluster of lithic debris. Faunal remains are mostly bison, as well as northern pocket gopher that may be intrusive. Artifacts are distributed mostly around the boiling pit (Webster 2004). Radiocarbon ages from Level 2 include 3440 B.P., 3348 B.P. from Occupation 2a, and 3430 B.P. from Occupation 2b (Webster 2004).

Cultural Level 3 is associated with a McKean Lanceolate projectile point. Another projectile point, similar to Besant, was recovered in this level but thought to be a secondary deposit due to rodent burrowing. Other artifacts include bifacial tools, bifacial preforms, cores, endscrapers, a hammerstone, retouched lithics, perforators, spokeshaves, and wedges. Faunal remains include bison, canid, and northern pocket gopher. Features include a small basin shaped hearth and a broken rock and lithic debitage concentration. It is thought that this was a hide processing area and a secondary bison processing area. The bone bed is the first identified McKean kill site in the Canadian Plains. The radiocarbon age of this level is approximately 4140 B.P. (Webster 2004). No floral remains were reported.

Sullivan site (EjNr-1) is likely a bison kill located east of the South Saskatchewan River. The site revealed 5 artifact localities including surface collections and buried components. Many of the artifacts were in a disturbed context. Artifacts include Duncan projectile points, scrapers, choppers, knives, and bifacial tools (Johnson 1975). Test excavations were later conducted and two paleosols were noted, the upper was associated with a Duncan projectile point (Ramsay

1993). The majority of projectile points recovered were Duncan. Other diagnostic points include Oxbow and Pelican Lake. Considerable amounts of bone were found on the surfaces as well as in the excavation units. Remains included both butchered and articulated bison (Johnson 1975). No floral remains were reported.

Camp Rayner (EgNr-2) is a multicomponent site located on the northern shoreline of Lake Diefenbaker. Seven cultural zones were identified with the following affiliations: Prairie side-notched, Pelican Lake, Sandy Creek, McKean, Mummy Cave, Plains Mountain/Lusk. Cultural Zone 3 contained Sandy Creek and McKean points and Zone 5 contained possible McKean points and Pelican Lake projectile points. Artifacts from Zone 3 included projectile points, bifaces (complete and fragmented), unifaces, endscrapers, sidescrapers, spokeshave, retouched flakes, hammerstones, and a pottery sherd (out of original context). Identifiable faunal remains included bison, snowshoe hare, *Canis* sp., and muskrat (Cahill 2012). No floral remains were reported.

5.3.2.2 Sites in the Aspen Parkland/Northern Glaciated Plains

Long Creek (DgMr-1) is a multicomponent site near Estevan on a tributary of the Souris River. Nine cultural levels were identified and Level 5 is associated with the McKean Complex. Other cultural affiliations include Avonlea, Pelican Lake, and Oxbow. This level is associated with a Hanna projectile point and a radiocarbon age of 3370 B.P. A re-analysis of the site by Bryant (2002:115) produced a date of 3865 B.P. for this level. Artifacts included a projectile point, scrapers, a perforator, a chopper, modified flakes, and lithic debitage (Wettlaufer and Mayer-Oakes 1960). A coyote canine with indentations and that was rubbed with red ochre may have been used as a gaming piece. Faunal remains include bison, dog, pocket gopher, cottontail rabbit, and human (not a burial). Bryant (2002) reanalyzed the site and level 5 may represent separate occupations. The Hanna point is associated with level 5A and a date was submitted producing an age of 3775 B.P (Bryant 2002). No floral remains were reported.

5.3.2.3 Sites in the Mid-Boreal Uplands and Peace-Wabaska Lowlands

The Crown site (FhNa-86) is currently covered by Tobin Lake and was discovered during a CRM study prior to the construction of the Nipiwan Reservoir. The site was located on the edge of the boreal forest on a terrace on a tributary of the Saskatchewan River (Quigg 1986).

Three components were identified. The upper component is associated with the Late Prehistoric Period, the middle component is associated with Hanna material and the lower level is associated with McKean Lanceolate material (Quigg 1986). Radiocarbon ages for the McKean components indicate that this site was used by the McKean Complex from 4445 - 3220 B.P. (Quigg 1986).

The middle component contains three to four Hanna occupations and was analyzed as a single component. This occupation is likely a spring occupation and indicative of activities such as processing large game, hide working, tool manufacture, and food preparation (Quigg 1986:160). Artifacts included projectile points unifaces, scrapers, bifaces, hammerstones, modified lithics and bone tools. Oxbow and Mummy Cave points were also associated with this level though no components of these cultures were found at the site. It is thought that they may have been collected elsewhere and brought to the site (Webster 2004:46). Lithic materials are mostly local. Faunal remains are very fragmentary and include bison, moose, elk, deer, hare, beaver, canid, fish, and clamshells (Quigg 1986). Features include a basin shaped hearth, a burial, and a fire-broken rock concentration. The burial was an extended burial that was intact and found within a shallow pit. There were no grave goods or red ochre associated with the burial. The age of the skeleton is approximately 2.5 – 3 years of age (Walker 1984). No floral remains were reported.

The McKean component contains only McKean Lanceolate points and the majority of them were made of Swan River Chert. Artifacts associated with this level include projectile points, bifaces, scrapers, unifaces, modified lithics, hammerstones, debitage, and bone tools. Faunal remains include bison, elk, moose, canid, beaver, skunk, hare, sharp-tailed grouse, fish, clam, as well as many other small mammals. Features include surface hearths and a bone concentration. This component is interpreted as a winter occupation of several small and temporary campsites. Activities at the site would have included tool manufacture, hide working, and food preparation (Quigg 1986). No floral remains were reported.

The Lubyk site (FhNh-138) is a campsite along the top of the North Saskatchewan River Valley near Prince Albert. This site is a large surface find and it is disturbed. Diagnostic projectile points include Angostrura, McKean Lanceolate, and Late Precontact points. Of the 60 diagnostic projectile points the majority are Hanna (Frey 1997). Artifacts included projectile points, debitage, cores, and bifaces. Lithic materials are mainly local with exotics such as Cathead chert and Tongue River silicified sediment. Also associated with this site are large

concentrations of FCR. This site likely represents a campsite in which primary activities include the reduction of rough materials and the production and maintenance of stone tools (Frey 1997:59). No floral remains were reported.

The Berry Picker site (FhNc-8) is located in a cultivated field with a discrete McKean occupation Artifacts include McKean Lanceolate projectile points, a hafted biface, two point preforms, bifaces, endscrapers, unifaces, perforators, retouched flakes, hammerstones, debitage, cores, and core fragments (Finnigan et al. 1983).

5.4 McKean Sites in Manitoba

5.4.1 Introduction

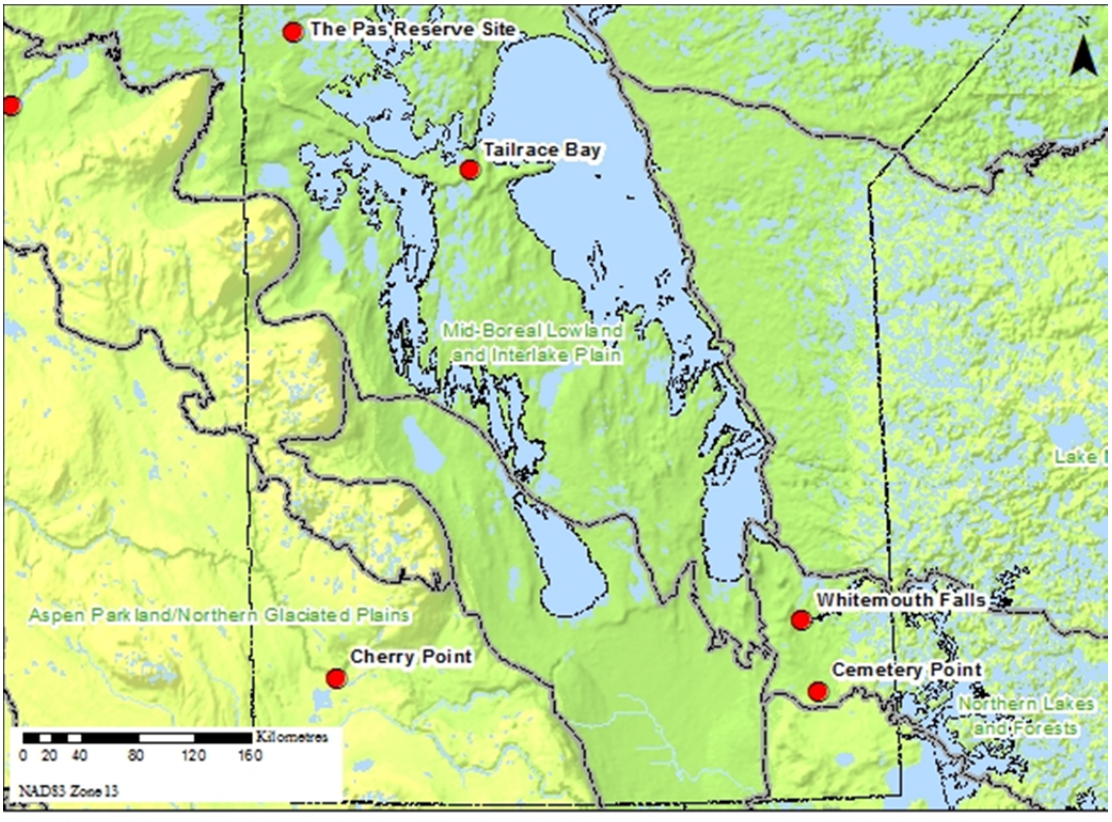
In Manitoba, the sites examined in this thesis are located in the following ecoregions: the Mid-Boreal Lowland and Interlake Plain, the Aspen Parkland/Northern Glaciated Plains, and the Northern Lakes and Forests. Boyd (2000:35) found that the McKean site distribution is associated with modern lowlands, rivers, wetlands, and lakes, with fewer sites located in the higher areas of the Manitoba Escarpment. Features include charcoal filled pits. Faunal remains include mammals, fish, birds, and beavers. Site locations suggest that fish may be an important resource. Surface sites in Manitoba are generally located along rivers or major tributaries and in lowland areas. There were a wide range of McKean variants (Syms 1969:108). Most of the sites are located west of Portage La Prairie in the western half of the province and most artifacts were made from local lithic materials (Syms 1969:130).

Buchner (1979:94) outlines characteristics of the McKean Complex in Manitoba. Faunal remains includes bison, cervid, coyote, dog, pocket gopher, cottontail rabbit, birds, beaver, bear, deer, and fish. Hearths are shallow and elliptical lined with stones. Common lithics include concave based stemmed points, small endscrapers, bifaces, crude chopping tools, polyhedral cores, utilized flakes, pebble hammerstones, and fire-cracked rock.

Table 5.3 Radiocarbon Ages of Manitoba McKean Components

Site Name	Site #	Context	Associated Points	Date B.P.	Material	Lab No.	Source
Cherry Point	DkMe-10	Occupation A	D/H	1020 +/- 110	Bone	S-1033	Balcom 1976, Haug 1975
Cherry Point	DkMe-10	Occupation B	D/H/mixed	1850 +/- 100	Bone	S-1031	Balcom 1976, Haug 1975
Cherry Point	DkMe-10	Occupation B	D/H/mixed	2060 +/- 130	Bone	S-1032	Balcom 1976, Haug 1975
Cherry Point	DkMe-10	Occupation C	D/H/mixed	2830 +/- 260	Bone	S-1030	Balcom 1976, Haug 1975
Cherry Point	DkMe-10	Occupation C	D/H/mixed	2860 +/- 210	Bone	S-1029	Balcom 1976, Haug 1975
The Pas Reserve site	FbNp-5	Archaic component	D/H	3190 +/- 60	Charcoal	BGS-2369	Tamplin 1977
Whitemouth Falls	EaLa-1	Level 2	L	3405 +/- 175	Bone	GX-4415	Butchner 1979

Legend: H = Hanna, D = Duncan, L = McKean Lanceolate, mixed = other cultural association



(Buchner 1979; CEC 2011; ESRI 2008; Haug 1975; MacNeish 1958; Syms 1969; Tamplin 1977)

Figure 5.3 Manitoba Sites Associated with the McKean Complex

5.4.2 Description of Sites

5.4.2.1 Sites in the Mid-Boreal Lowland and Interlake Plain

The Pas Reserve site (FkMh-5) is located on the north bank of the Saskatchewan River. The campsite contained Selkirk, Avonlea, Laurel, and Duncan components. A burial was also discovered near the campsite associated with a Besant projectile point as well as two unknown projectile point types. Tools include endscrapers and side scrapers. Features include two small charcoal filled pits. Faunal remains include bison, fish, and canid (Tamplin 1977). A radiocarbon age of 3190 B.P. is associated with the Duncan component (Tamplin 1977). No floral remains were reported.

The Tailrace Bay site (GRS-1) is located near Grand Rapids on the shore of the Saskatchewan River. There were three levels of occupation identified and the 'gravel zone' contained multiple McKean Lanceolate points and a Duncan point (Syms 1969). Though faunal remains were not separated by level, remains included seven fish species, 18 mammal species, and 34 bird species. The location of the site, in close proximity to rapids may also indicate that fishing was an important subsistence activity (Syms 1969). No floral remains were reported.

5.4.2.2 Sites in the Northern Lakes and Forests

Whitemouth Falls (EaLa-1) is located near Seven Sisters Falls in Manitoba. The site was occupied from the early Holocene to the Late Woodland Period. The site has an early Holocene burial (Buchner 1979). The radiocarbon age for the McKean component (Component 2) was 3405 B.P. (Buchner 1979:95). No floral remains were reported.

The Cemetery Point site (EaKv-1) is a multicomponent site on the shore of Nutimik Lake near the mouth of the Whiteshell River. This site had considerable mixing between levels, though level 6 may be an intact McKean occupation with McKean Lanceolate and a Duncan point. Faunal remains include a beaver and a multi-barbed antler harpoon. The presence of the harpoon and the location of the site suggest that fishing was an important activity, though no fish remains were identified in Level 6 (MacNeish 1958). No floral remains were reported.

5.4.2.3 Sites in the Aspen Parkland/Northern Glaciated Plains

Cherry Point (DkMe-10) is located at the north end of Oak Lake. All the dates are younger than expected from their artifact association. Occupation A, located beneath the plow zone produced dates of 1020 B.P. and 1040 B.P. along with associated Duncan and Hanna projectile points. These ages were rejected due to their late age. Occupation B produced dates of 1850 B.P. and 2060 B.P. along with Oxbow, Duncan, and Hanna projectile points. Occupation C produced dates of 2830 B.P. and 2860 B.P. and Oxbow, Duncan, and Hanna points (Haug 1975). No floral remains were reported.

5.5 McKean Sites in Wyoming

5.5.1 Introduction

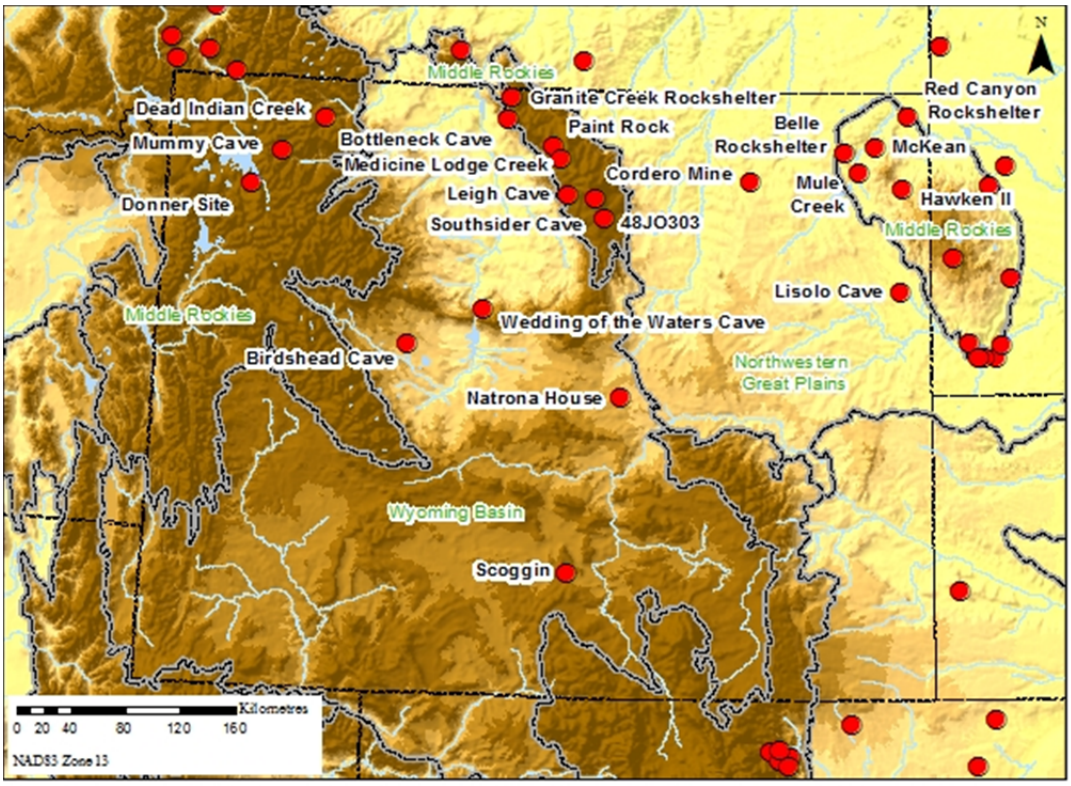
The Wyoming McKean sites examined in this thesis are located within three ecoregions: the Middle Rockies, and the Wyoming Basin, the Northwestern Great Plains. Within the Middle Rockies the sites are present in the Absaroka Range, the Bighorn Mountains, and the Black Hills. Sites are often located near major watersources.

McKean sites in Wyoming date from approximately 4590 - 3260 years B.P. Sites with Lanceolate points occur from 4590 – 3790 B.P., Duncan from 4590 – 3520 B.P., and Hanna from 4590 – 3260 B.P.. The Scoggin site also contained a Mallory point and this dated to 4550 B.P. The oldest sites appear to be located in the northwest, northeast, and southcentral parts of the state in the Middle Rockies and Wyoming Basin Ecoregions. The youngest sites are located along the periphery of the northern border.

Subsistence is quite varied with many different mammals present in the faunal assemblages. A bison processing site as well as a bison jump and trap site were found in the Plains region. Features include basin hearths, stone lined hearths pit hearths, stone lined pits, cache pits, pit houses, burials, stone platforms, boiling pits, and petroglyphs. Site types include open air campsites, rockshelter sites, processing sites, and kill sites. Manos and grinding slabs are found in some of the sites as well as floral remains (Table 4.1).

In examining Figure 5.5 we see that there are some areas that appear to be absent of sites, though this is not the case. There are sites associated with the McKean Complex that include surface scatters and artifact finds. Upon review of a map of these site locations apparent

clustering is the result of resource development and the resulting CRM work that has been conducted in these areas (R. Hilman, 2014 personal communication).



(CEC 2011; ESRI 2008; Frison 1962; 1991; Frison and Huseas 1968; Husted 1962; Husted and Edgar 2002; Kornfeld 1995; Kornfeld and Frison 1985; Lobdell 1974; McClelland and Martin 1999; Morlan n.d., Reher et al. 1985; Steege and Paulley 1964; Tratebas 1998; Wedel et al. 1968; Wheeler 1995b; 1995c; Wilson 1984)

Figure 5.4 Wyoming Sites Associated with the McKean Complex

Table 5.4 Radiocarbon Ages of Wyoming McKean Components

Site Name	Site #	Context	Associated Points	Date B.P.	Material	Lab No.	Source
Bottleneck Cave	48BH20	Occupation IV	D/H/L	3820 +/- 200	Charcoal	SI-239	Husted 1962
Cordero Mine	48CA75	Area 1	D/H	3520 +/- 150	Charcoal	RL-805	Reher et al. 1985
Dead Indian Creek	48PA55	Area 1	D/L/mixed	3800 +/- 110	Charcoal	RL-321	Wilson 1984
Dead Indian Creek	48PA55	Area 1	D/L/mixed	4180 +/- 250	Charcoal	W-2597	Wilson 1984
Dead Indian Creek	48PA55	Area 1	D/L/mixed	4430 +/- 250	Charcoal	W-2599	Wilson 1984
Leigh Cave	48WA30	Single occupation	D/H	4170 +/- 150	Charcoal	Grey no. 25	Frison and Huseas 1968
McKean	48CK7	Housepit hearth	D/H/L	3790 +/- 140	Charcoal	RL-1860	Kornfeld 1995; Kornfeld and Frison 1985
McKean	48CK7	Location 2, Block 1	D/H/L	4590 +/- 160	Charcoal	RL-1861	Kornfeld 1995; Kornfeld and Frison 1985
Medicine Lodge Creek	48BH499		D/H/L	3980 +/- 160	Charcoal	RL-96	Frison 1991:85
Medicine Lodge Creek	48BH499		D/H/L	4050 +/- 150	Charcoal	RL-438	Frison 1991:85
Mummy Cave	48PA20	Layer 30	D/L	4090 +/- 140	Charcoal	I-1580	Morlan n.d
Mummy Cave	48PA20	Layer 30	D/L	4170 +/- 130	Charcoal	I-1582	Morlan n.d
Mummy Cave	48PA20	Layer 30	D/L	4375 +/- 180	Charcoal	I-1034	Morlan n.d
Mummy Cave	48PA20	Layer 30	D/L	4420 +/- 150	Charcoal	I-1428	Wedel et al. 1968
Natrona Housepit site	48NA2526	Middle Feature 4	D/H/L/mixed	3820 +/- 50	Charcoal	NA2526-4	McClelland and Martin 1999
Natrona Housepit site	48NA2526	Top Feature 4	D/H/L/mixed	3870 +/- 50	Charcoal	NA2526-3	McClelland and Martin 1999
Natrona Housepit site	48NA2526	Bottom Feature 4	D//H/Lmixed	3870 +/- 50	Charcoal	NA2526-5	McClelland and Martin 1999
Natrona Housepit site	48NA2526	Feature 4.3	D/H/L/mixed	3910 +/- 50	Charcoal	NA2526-7	McClelland and Martin 1999
Natrona Housepit site	48NA2526	Feature 4.2	D/H/L/mixed	3920 +/- 50	Charcoal	NA2526-6	McClelland and Martin 1999
Natrona Housepit site	48NA2526	Bottom Feature 4	D/H/L/mixed	4080 +/- 70	Charcoal	S-5-15-2	McClelland and Martin 1999
Natrona Housepit site	48NA2526	Feature 9	D/H/L/mixed	4840 +/- 50	Charcoal	NA2526-8	McClelland and Martin 1999
Paint Rock V	48BH34	unknown	D/H/L	4310 +/- 140	Charcoal	RL-482	Frison 1991
Red Canyon Rockshelter	48CK1395	Component II	H/L	3260 +/- 80	Charcoal	Beta-3783	Tratebas 1998, on file WSHPO
Red Canyon Rockshelter	48CK1395	Component II	H/L	4440 +/- 60	Charcoal	Beta-81537	Tratebas 1998, on file WSHPO
Red Canyon Rockshelter	48CK1395	Component II	H/L	4550 +/- 130	Charcoal	Beta-73784	Tratebas 1998, on file WSHPO
Scoggin	48CR30	Single occupation	L/M	4540 +/- 110	Charcoal	L-3858	Lobdell 1974
Southsider Cave	48BH364	n/a	L	3900 +/- 140	Charcoal	RL-668	Frison 1991
Southsider Cave	48BH364	n/a	L	4170 +/- 150	Charcoal	RL-672	Frison 1991

Legend: H = Hanna, D = Duncan, L = McKean Lanceolate, M = Mallory, mixed = other cultural association

5.5.2 Site Descriptions

5.5.2.1 Sites in the Middle Rockies

Belle Rockshelter (48CK4) is located along the Belle Fourche River in the Cretaceous Fox Hills. It is a seasonal occupation likely of a family unit. Both Hanna and McKean Lanceolate points are associated with this site. Two radiocarbon ages were retrieved from the McKean components of 1295 B.P. and 1815 B.P.; both were rejected for being too late. Component B is associated with the Hanna projectile point. Tools associated with this level include projectile points, an endscraper, a flake scraper, knives, scrapers, a chopper, and utilized flakes. Two hearths were also found. Faunal remains include bison, deer or pronghorn, and shell. Fruit pits were also found, but are associated with rodent activity. Component C is associated with a McKean Lanceolate point. Tools include projectile points, knives, endscrapers, a palette, a piece of hematite, a hand hammer, and many flakes. Three hearths were also uncovered (Wheeler 1995b:47-56). No floral remains were reported.

The McKean site (48CK7) is located on the Belle Fourche River and is the site for which the McKean Complex is named. Two cultural strata were recognized, with continuous artifact distribution through the deposits. It was suggested that there were many short term occupations over the lifespan of the site (Frison 1991; Kornfeld et al. 1995). Artifacts in the lower level included McKean Lanceolate, Duncan, and Hanna projectile points, scraping tools, metates, manos, engraved bone, and decorated bone beads. Features include hearths, (irregular or shallow depressions), stone lined pits, stone filled basin depressions, cache pits, and a knapping feature (Mulloy 1954). Two McKean burials were also found. A human skull of a female approximately 30 years old was found in a cache pit in association with bison bones. The other burial was a secondary burial of a child found in a pit. A deer pelvis and a hematite slab were found above this burial (Kornfeld 1995; Mulloy 1954). Faunal remains include bison, rabbit, reptile, bird, rodent, pronghorn, dog/wolf, and deer. A house pit was also found in the McKean component similar to those of the Early and Middle Archaic pit houses in Wyoming (Larson 1997). There are fewer grinding stones than found in the later occupation (Kornfeld 1995:311). Radiocarbon ages include one from the house pit hearth which dated to 3790 B.P. and one from Locality II at 4590 B.P. (Kornfeld 1995; Kornfeld and Frison 1985).

Bottleneck Cave (48BH206) is a rockshelter campsite on the bank of the Big Horn River. This site has five levels of occupation (Husted 1962). Other projectile point styles found at this site include Lovell Constricted, Pryor Stemmed, Agate Basin, McKean, Pelican Lake, and Plains side-notched. Level IV contains Duncan and McKean Lanceolate projectile points. Features include basin shaped fire pits and deep rock filled pits. Artifacts include knives, scrapers, side scrapers, a graver, a chopper, modified flakes, a grinding stone, and pigment. Faunal remains include deer or antelope, bighorn sheep, coyote, rabbit, pack rat, mouse, and fish. A radiocarbon age of 3820 B.P. was obtained for Level IV. There are two post holes in the shelter, one near the north side and one inside the south side inside the shelter (Husted 1962). No floral remains were reported.

The Medicine Lodge Creek site (48BH499) contained McKean diagnostics mixed with other less well known Middle Plains Archaic diagnostics (Frison 1991:100). Radiocarbon ages of 3960 B.P. and 4050 B.P. are associated with the McKean projectile points (Webster 2004). Other cultural affiliations include Late Prehistoric, Late Archaic, Pelican Lake, Pryor-Stemmed, Foothill-Mountains Paleoindian points, Cody Complex, and Goshen or Plainview (Frison 1991:28). This site contains petroglyphs as well as buried cultural material. The site is located approximately 100 metres west of the junction of the dry forks of Medicine Lodge Creek and the wet fork of that stream. The site is well protected from the winter winds. The petroglyph portion of the site is located on a sandstone cliff. The petroglyphs are of shield bearing persons and of animals, some of which are life size (Frison 1991). The petroglyphs are not necessarily associated with the McKean Complex.

The Dead Indian Creek site (48PA551) is located beside Dead Indian Creek near the east flank of the Absaroka Mountains (Wilson 1984). Artifacts include many McKean projectile points and a Late Archaic point, a blade, a biface, a chopper, a core, a drill, retouched flakes, drills, a scraper, endscrapers, knives, gravers, hammerstones, debitage, manos, metates, abraders, steatite pipe, and bone tools (Simpson et al. 1984). Faunal remains include mule deer, mountain sheep, bison, cottontail, snowshoe hare, molluscs, gastropods, birds, squirrel, porcupine, wolf or dog, black bear, mule deer, pronghorn, marmot, northern pocket gopher, vole, muskrat, woodrat, and elk. Cobbles were found in pits. Features include fire hearths, pits (basin and surface) that were circular, elongated, or rectangular in shape. Radiocarbon dates include 3800 B.P., 4430 B.P., and 4180 B.P. This site contains a mule deer antler feature where the skull cap and antlers

in a pit were covered with large cobbles. This may be ceremonial or functional in nature though there is the possibly of this feature being a food cache (Frison and Walker 1984). This site is also associated with a child burial (Gill 1984) as well as a house pit depression (Simpson et al. 1984).

Leigh Cave (48WA304) is a single component habitation site on the western slope of the Bighorn Mountains. Perishable material recovered included twisted cordage made of milkweed and juniper bark, yucca fibre, sinew, hide, and deer and mountain sheep hair. Tools include Lanceolate and stemmed McKean projectile points, scrapers, a core, chopper, retouched flakes, sandstone milling stones, manos, a shaping tool, a hammerstone, and a bone awl. There was a lack of big game at this site with a reliance on smaller game. Faunal remains include Mountain Sheep, deer, grey squirrel, and coyote. A surface hearth contained hundreds of Mormon crickets. Floral remains include bulb covering of *Allium* sp. (wild onion), *Prunus demissa* (chokecherry), seeds from *Pinus flixilis* (Limber pine), *Rosa woodsia* (Wild rose), and *Sheperdia argentea* (buffalo berry). A hearth was the only feature at the site. The remains of this site are more reminiscent of the Desert Culture than Plains Archaic (Frison and Huseas 1968).

Mummy Cave (48PA201) is a large rockshelter on the North Fork of the Shoshone River near the mouth of Blackwater Creek in the Absaroka Mountains (Husted and Edgar 2002). This site has been occupied over the last 9000 years with 38 cultural layers being identified from Late Paleoindian to Late prehistoric times. Level 30 is associated with the McKean Complex. Artifacts included projectile points, tubular bone pipes, coiled basketry fragments, fibre cordage, netting, wood trimmings, leather scraps, flintchips, animal bones, and grinding stones. Radiocarbon ages range from 4090 to 4375 B.P. (Husted and Edgar 2002).

Red Canyon Rockshelter is located in the Bear Lodge Mountains. Component II contains a Hanna point and a McKean Lanceolate projectile point with slightly serrated edges. Two hearths were associated with this component. No bones were identifiable due to their fragmented nature. Component IIA is possibly McKean though there were no diagnostics. Component IIB contained Hanna projectile point as well as a hearth. Plant remains include *Chenopodium* sp. (Tratebas 1998) though there have been no grinding stones associated with this site (Webster 2004:65). Radiocarbon dates include 3260 B.P. from Component IIB, 4440 B.P., and 4550 B.P. from Component II. The interpreted activity of Component IIB was faunal processing. This site is likely a spring occupation (Tratebas 1998:279).

Southsider Cave (48BH364) is a rockshelter site on the western slopes of the Bighorn Mountains (Frison 1991:100). This site contains diagnostic projectile points from Late Paleoindian, Early Plains Archaic, Middle Plains Archaic, Late Plains Archaic, and Late Prehistoric Periods. Faunal remains include bison, mule deer, mountain sheep, elk, yellow-bellied marmot, porcupine, and cottontail rabbit (Huter 2003). Radiocarbon ages include 3900 B.P. and 4170 B.P. (Frison 1991). No floral remains were reported.

Mule Creek Rockshelter (48CK204) is located along the Belle Fourche River in the foothills. The Component D contained McKean Laneolate, Duncan, and Hanna points. Other projectile points from other components include Middle Archaic points, and a possible Angostura point. Artifacts include knives, drills, flake scrapers, an endscraper, manos, a grinding slab, and a pestle. Features include hearths including a stone filled basin and stone platforms. Faunal remains include bison, deer or pronghorn, canid, beaver, grouse, and shellfish. A seasonal occupation, presence of shellfish suggests a warm weather occupation (Wheeler 1995b:61-116). No floral remains were reported.

Painted Rock V (48BH34) is a rockshelter in the Bighorn Mountains. It has a radiocarbon date of 4310 B.P. This date was taken from a fire pit in a level with McKean Lanceolate and stemmed points (Frison 1991).

5.5.2.2Sites in the Wyoming Basin

Birdshead Cave (48FR54) is a dry, low cavern near a spring in Burgess Canyon (Wheeler 1995c:7). Lens 5 contained a Duncan projectile point. A single hearth, subcircular in shape was uncovered. Stone tools include cores, bifaces, a uniface, a projectile point, knives, a hand-drill, flakes, a chopper, a hand-hammer, and a hand stone. One bone tool was also present. Faunal remains include deer, pronghorn or bighorn sheep, cottontail, and grouse. A horn coral fossil was also found. Vegetal remains include juniper berries and wood remains (Wheeler 1995c).

The Scoggin site (48CR304) is located on a dry tributary of the North Platte River (Frison 1991:101). This site is a bison kill site including a jump and trap. It is a single component site and contains McKean Lanceolate and Mallory projectile points. Radiocarbon dates include 4540 B.P., 3445 B.P., and 3400 B.P. Features include a bison jump and trap as well as boiling pits located in the processing area (Lobdell 1973). No floral remains were reported.

Wedding of the Waters Cave (48HO301) is a rockshelter site at the mouth of Wind River Canyon near a mineral spring. This site has easy access to both the badlands and the mountains. In the lowest level a McKean Lanceolate and a Hanna projectile point were uncovered as well as unworked flakes. There were no faunal remains related to cultural activity, nor were there any features (Frison 1962). No floral remains were reported.

The Natrona Housepit site (48NA2526) is a residential campsite located on an east-facing slope of a mesa. The primary activity at this site was processing of small game. It is located near a tributary of Middle Casper Creek (McClelland and Martin 1999). This site is a single component that represents a series of short-term open camps that date from the Early Plains to the Late Plains Archaic. The occupations could not be separated vertically or horizontally. A Late Paleoindian Foothill/Mountain complex point was recovered from the bottom of the house pit. It was undetermined if this was a recycled point or if it was indicative of a Late Paleoindian occupation and the point was translocated into the housepit by a disturbance. The Middle Plains Archaic occupation was the most prominent occupation and is represented by the house pit. Two McKean Lanceolate points were recovered from the housepit. A Duncan/Hanna point was also found within a unit in the housepit. A Mallory point that was extensively reworked into a hafted drill was found in the housepit during testing. The housepit (Feature 4) contained internal and external features (McClelland and Martin 1999).

Other artifacts found at the Natrona Housepit site included bifaces, flaked tools, cores, modified cobbles, heat-altered rock, bone and tooth fragments, and a mussel shell. Internal features included a basin, a slab-lined basin, and a heat altered rock concentration. External features were unoxidized basins (McClelland and Martin 1999). The faunal assemblage was dominated by very small mammals including jackrabbit, prairie dog, pocket gopher, cottontail rabbit, and ground squirrel. A pronghorn was also identified. The overall size of bone fragments suggests that bone grease manufacture occurred at this site. Identified floral remains include *Chenopodium* sp. seeds and a *Opuntia polyacantha* seed. Radiocarbon ages include 4080 B.P. (Bottom of Feature 4), 3870 B.P. (Upper portion of Feature 4), 3820 B.P. (Middle Portion of Feature 4), 3870 B.P. (Lower Portion of Feature 4), 3920 B.P. (Feature 4.2), 3910 B.P. (Feature 4.3), and 4840 B.P. (Feature 9) (McClelland and Martin 1999).

5.5.2.3 Sites in the Northwestern Great Plains

Lissolo Cave (48WE301) is located on Crane Creek on a terrace adjacent to a rockshelter (Steege and Paulley 1964). The lowest level has associated McKean points. Features include shallow unlined basin hearths and a scatter of fragmented animal bone. Artifacts include blade tools, endscrapers, a graver, drill fragment, a flake knife, a fragment of decorated bone, a mano and metate. Faunal remains include bison, elk, and mule deer, all broken into small pieces. The middle level had surface hearths, Duncan, Hanna, and Oxbow points, and a slab metate. The upper level contained corner notched points (Steege and Paulley 1964).

The Cordero site (48CA75) is a bison processing site in the Powder River Basin. It was occupied from the Middle Plains Archaic to the Protohistoric Period. Features uncovered in the Middle Plains Archaic level include shallow pit features, fire hearths, rock heating hearths with FCR, and stone boiling pits. This level produced an age of 3520 B.P. Tools include projectile points, flakes, bifaces, retouched flakes, endscrapers, and preforms. Faunal remains include pronghorn and bison which was intensively processed. At this site the material remains indicate activities of specialized big game hunters and not those of general foragers (Reher at al. 1985:120). No floral remains were reported.

5.6 McKean Sites in Montana

5.6.1 Introduction

The McKean Complex is locally referred to as the Hayden Valley Subphase in Montana. Intact McKean components are few due to mixed stratigraphy as well as cultivation (Davis et al. 2012). Sites are located in either the Middle Rockies or the Northwestern Great Plains ecoregions. Montana contains both the oldest and the youngest McKean radiocarbon ages. The oldest sites, Sorenson and Rigler Bluffs, date between 5040 and 4900 B.P. while the youngest, Quinn Creek, dates to 2830 B.P. The sites in this analysis are clustered along the southern border of the state. McKean projectile point styles include McKean lanceolate, Duncan, Hanna, and Mallory. Lanceolate and Duncan projectile points are associated with the oldest sites and Duncan and Hanna with the youngest.

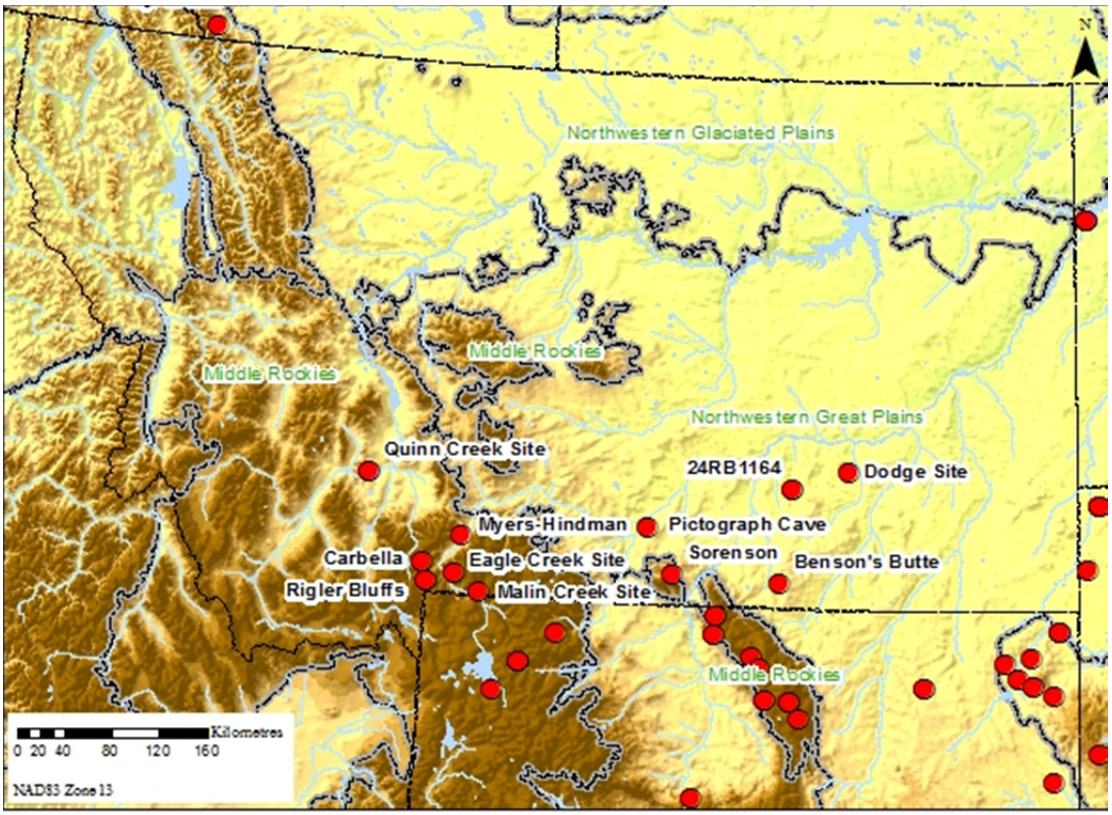
Types of sites found in Montana include open air campsites, rockshelters, and a cache site. Activities include habitation, small scale hunting, food processing, and tool manufacture.

Common features include rock lined basins. Faunal remains include large, medium, and small mammals, as well as fish. Sandstone slabs, and floral remains were found at Malin Creek.

Table 5.5 Radiocarbon Ages of Montana McKean Components

Site Name	Site #	Context	Associated Points	Date B.P.	Material	Lab No.	Source
24RB1164	24RB1164	Task Area 4	D/H/M	3310 +/- 90	Bone	Beta-35225	Munson 1992
Benson's Butte	24BH1726	Middle Archaic Level	D/H/L/mixed	4230 +/- 50	Charcoal	TX-2797	Fredlund 1981
Malin Creek	24YE33	Feature c	H	4580 +/- 50	Charcoal	Beta-174888	Davis et al 2012
Malin Creek	24YE33	Feature e	H	5050 +/- 50	Charcoal	Beta-174889	Davis et al 2012
Meyers-Hindman	24PA504	Settlement Unit 4	D/H/L/mixed	3150 +/- 110	Bone	Gak2630	Lahren 1976
Meyers-Hindman	24PA504	Settlement Unit 4	D/H/L/mixed	3530 +/- 110	Charcoal	Gak2629	Lahren 1976
Quinn Creek site	24JF110	XB:1	D/H	2830 +/- 90	Bone	Beta-11447	Rennie and Hughes 1998
Rigler Bluffs	24PA401	Hearth feature	L	4900 +/- 300	Charcoal	W-1135	Haines 1966
Rigler Bluffs	24PA401	Hearth feature	L	5040 +/- 150	Charcoal	Grey no 29	Haines 1966
Sorenson	24CB202	Occupation V	D/mixed	4900 +/- 250	Charcoal	I-691	Ruebelmann 1982

Legend: H = Hanna, D = Duncan, L = McKean Lanceolate, M = Mallory, mixed = other cultural association



(Arthur 1966; CEC 2011; Davis 1976; Davis et al. 2012; ESRI 2008; Fredlund 1979; Haines 1962; Lahren 1976; Munson 1992; Rennie and Hughes 1998; Ruebelmann 1982)

Figure 5.5 Montana Sites Associated with the McKean Complex

5.6.2 Site Descriptions

5.6.2.1 Sites in the Middle Rockies

The Quinn Creek site (24JF110) is an open air campsite along the base of Bull Mountain. Artifacts include projectile points, bifaces, endscrapers, cores, retouched stone tools, and debitage. Faunal remains include both large and small ungulates. Features include a rock line pit. FCR was also uncovered. No plant remains were identified in the macrofloral analysis. Hematite was recovered in a cluster (Rennie and Hughes 1998). A radiocarbon date of 2830 B.P. was taken from the McKean component in XB:1. Diagnostic projectile points included Duncan and Hanna projectile points (Rennie and Hughes 1998).

Rigler Bluffs (24PA401) contained stemmed points and a hearth was dated to 4900 B.P. and 5040 B.P. from charcoal in the hearth feature. The hearth was basin shaped and rock lined. Artifacts included a McKean point (Haines 1966:5).

Malin Creek (24YE353) is located on a terrace of the Yellowstone River in the Black Canyon. Component 3 is mixed with distinct occupations. Projectile points are identified as the Hayden Valley Subphase (Hanna). Faunal remains include bison, elk, bighorn sheep, and fish. Pollen and macrofossil analysis identified prickly pear and grass seeds. Features include multiple very shallow basin shaped hearths surrounded by circular rings of stone (Davis et al. 2012:89). Two sandstone slabs were found in one of the hearths (Davis et al. 2012:89).

The Sorenson site (24CB202) is a small rockshelter located in the Bighorn Canyon (Ruebelmann 1982:112). This site was occupied from Late Paleoindian to Historic times. Occupation V contained Duncan points and Bitterroot points, knives, scrapers, and gravers. Features consisted of charcoal fire lenses. This level was dated to 4900 B.P. Occupation VI contained projectile points (small side-notched points, an Avonlea point, corner-notched point, Pelican Lake, and McKean Lanceolate), knives, scrapers, gravers, choppers, as well as bone, shell, wood, hide, feathers, and basketry items. Features included fire pits / hearths. Faunal remains included mule deer, bison, and coyote (Ruebelmann 1982:113).

Carbella (24PA302) is a single component site located at the mouth of the Yankee Jim Canyon where the Yellowstone River emerges into the Plains and close to the mouth of the Tom Miner Basin. The site is located on the primary terrace above the Yellowstone River. Diagnostic projectile points include Duncan, Hanna, and McKean. Remains reveal evidence of small scale

hunting activities focusing on multiple species. Stone tools were made from local materials. At the end of the Middle Prehistoric Period intensive occupation of this site ended indicating a shift in the hunting patterns in Paradise Valley (Arthur 1966). No floral remains were reported.

The Eagle Creek site (24PA301) is located near the 'high trail' above the Yellowstone River and near Eagle Creek in Montana (Arthur 1966). This trail was used during prehistoric times to move between the Gardiner vicinity and Paradise Valley (Arthur 1966). A substantial number of Middle Period projectile points have been found by collectors at this site. Level IV contains a rock lined hearth. The findings of Hanna and Lanceolate points are presumed to be associated with this level though this remains to be determined (Arthur 1966). No floral remains were reported.

The Meyers-Hindman site (24PA504) is located on the floodplain of Dry Creek, a tributary of the Yellowstone River (Lahren 1976:21). It was occupied from Paleoindian to Late Prehistoric times. Projectile points associated with this site include Agate Basin, Pinto Points, Bitterroot, and the Elko series. Settlement Unit 4 produced two radiocarbon ages of 3150 B.P. and 3530 B.P. (Lahren 1976:43). Faunal remains in this unit include pronghorn, beaver, bison, *Canis* sp., cottontail rabbit, deer, elk, jackrabbit, mountain sheep, porcupine, and *Ursus* sp. (Lahren 1976:47). Features included unlined shallow hearths and rock lined hearths. Charcoal and fire broken rock were also found around the hearths. Artifacts associated with this level included projectile points, anvil stones, bifaces, a bone awl, a core, an edge ground cobble, endscrapers, flakes, shaft smoother, utilized flakes, gravers, grinding stones, and hammerstones. Projectile points include Duncan, Hanna, McKean Lanceolate, and 'Elko Eared'. The variation in projectile points is similar to Layer 30 at Mummy Cave (Lahren 1976:84).

5.6.2.2 Sites in the Northwestern Great Plains

Benson's Butte (24BH1726) is located on a sandstone butte rising abruptly from the Youngs Creek Grasslands. This site may have been a focal point in the area from terminal Paleoindian to Protohistoric times (Fredlund 1981:90). No Early Plains Archaic evidence was found at this site. The Middle Archaic level was dated to 4230 B.P. Layers 1 and 2 contained McKean Lanceolate, Duncan, and Hanna projectile points. Level 1 also contained Frederick, Eden, and Agate Basin points. The assemblage is mixed (Fredlund 1981). No floral remains were reported.

The Dodge site (24RB1225) is a McKean cache located in the Tongue River Valley. The cache contained large notched bifaces, ovate bifaces, symmetrical bifaces, symmetrical uniface, ovoid uniface, flakes, and projectile points. Projectile points were comparable to the McKean stemmed variety (Davis 1976). No floral remains were reported.

24RB1164 is a campsite located in the Pine Parklands of Montana on a talus slope (Greiser and Greiser 1988:33) near the merging point of two seasonal drainages. This site was occupied from McKean complex time until the Late Prehistoric Period. The McKean Complex is best represented in Task area 4. Artifacts associated with this site include projectile points, bifaces, endscrapers, drills, modified flakes, and unifaces. Features include surface hearths and a refuse dump. Faunal remains include bison and deer. No flora analysis was conducted. A radiocarbon date for the McKean level was 3310 B.P. Diagnostic projectile points include Duncan, Mallory, and Hanna. Activities that took place at the site were food preparation and tool manufacture. Also at this site are two McKean Complex associated linear stone alignments, unusual for McKean (Munson 1992:14). No floral remains were reported.

Pictograph Cave I is located in the southern area of Montana. Occupation level 1 contained Eden, McKean Lanceolate, Duncan, and Pelican Lake projectile points. Other artifacts include scrapers, knives, choppers, flake tools, bone tools, a metate, a mano, and a pestle. Mulloy (1958) believed that the Eden point is intrusive, but it is likely that this is a mixed deposit. Occupation Level 2 contained both Pelican Lake and Hanna projectile points with a similar assemblage to Level 1 (Ruebelmann 1982:105). No floral remains were reported.

5.7 Colorado Sites

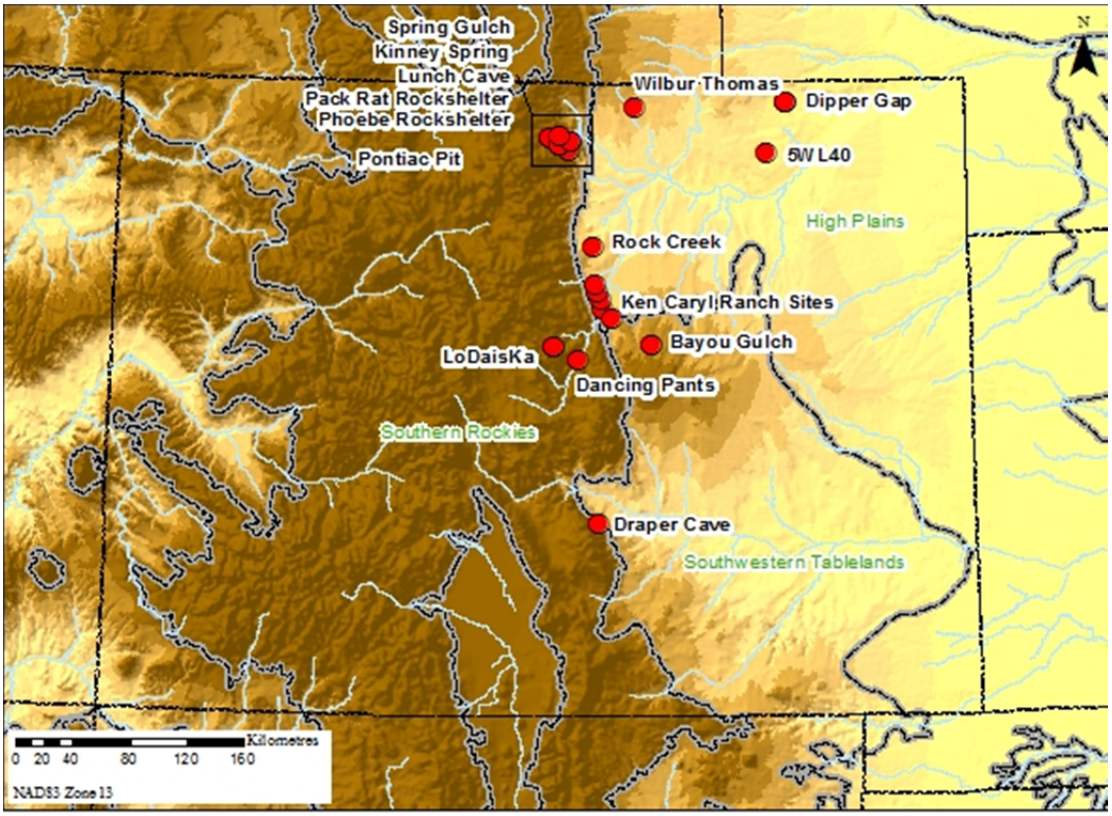
5.7.1 Introduction

The sites examined in this thesis are located in three main areas: the Southern Rockies, the High Plains, and the Southwestern Tablelands. In Colorado, the numbers of sites increase during the Middle Archaic Period with an increase on the Plains after the Altithermal (Gilmore et al. 1999). There are many sites located along the Front Range.

On the High Plains and the Southwestern Tablelands of Colorado many of the sites are open camps. Sites are located near watersources or in high locations overlooking watersources. Sites often contain multiple hearths. Types range from simple basins to rock filled hearths and

slab lined hearths. Sites often contains a variety of flaked and bone tools including an atlatl weight, gaming pieces, bone beads and paint palettes. Local material was used predominately to make flaked tools. Faunal remains indicate a reliance on large, medium, and small mammals. Macrofloral evidence from the Rock Creek Site suggests that a variety of seeds and plants were processed.

In the Southern Rockies, the sites are either open campsites or sheltered sites. The sites often have multiple hearths that are stone filled or slab lined. Artifacts include many flaked lithic and bone tools as well as ground stone tools. Faunal remains are typically medium to large animals. Sites that had floral remains include Dancing Pants, Spring Gulch site, and the LoDaiska site.



(CEC 2011; ESRI 2008; Gilmore et al. 1999)

Figure 5.6 Colorado Sites Associated with the McKean Complex

Table 5.6 Radiocarbon Ages of Colorado McKean Components

Site Name	Site #	Context	Associated Points	Date B.P.	Material	Lab No.	Source
5WL48	5WL48	Feature 12	D	3230 +/- 80	Charcoal	Beta-48810	Gilmore et al. 1999; Jepson et al. 1994; McFaul et al. 1994
Bayou Gulch	5DA265	Feature 14	D/H/L/M	3410 +/- 70	Charcoal	DIC-1508	Butler 1981; Gilmore et al. 1999
Bradford House II	5JF51	Hearth	D	3255 +/- 765	Charcoal	UGA-4000	Gilmore et al. 1999; Johnson et al. 1997; Richardson 1974;
Dipper Gap	5LO101	Locality 1, Zone D, feature 16	D/H	3180 +/- 90	Charcoal	UGA-456	Gilmore et al. 1999; Metcalf 1974
Dipper Gap	5LO101	Locality 1, Zone D, feature 5	D/H	3410 +/- 90	Charcoal	UGA-453	Gilmore et al. 1999; Metcalf 1974
Dipper Gap	5LO101	Locality 1, Zone D, feature 10	D/H	3520 +/- 85	Charcoal	UGA-455	Gilmore et al. 1999; Metcalf 1974
Falcon's Nest	5JF211	67-70 BGS	D/H/L/M/ mixed	2760 +/- 110	Charcoal	Beta-17605	Adkins 1993; Gilmore et al. 1999
Kinney Spring	5LR144	Site C, bank	L series	3250 +/- 80	Charcoal	Beta-6847	Gilmore et al. 1999; Morris et al. 1985
Kinney Spring	5LR144	Site C, L.87-97R.24F.9	L series	3800 +/- 70	Charcoal	Beta-7333	Gilmore et al. 1999; Morris et al. 1985
LoDaisKa	5JF142	Complex C	D/L	3150 +/- 100	Charcoal	m-1006	Gilmore et al. 1999; Irwin and Irwin 1961
LoDaisKa	5JF142	Complex C	D/L	3400 +/- 100	Charcoal	m-1004	Gilmore et al. 1999; Irwin and Irwin 1961
Lunch Cave	5LR288	Feature 2	H	3085 +/- 60	Charcoal	UGA-1864	Gilmore et al. 1999
Pack Rat Rockshelter	5LR170	11S13W, Feature 56	D/H/L	2440 +/- 80 (rejected)	Charcoal	Beta-2285	Gilmore et al. 1999; Morris et al. 1985
Pack Rat Rockshelter	5LR170	11S13W, Feature 57	D/H/L	2480 +/- 90 (rejected)	Charcoal	Beta-2288	Gilmore et al. 1999; Morris et al. 1985
Pack Rat Rockshelter	5LR170	11S13W, Feature 51	D/H/L	2760 +/- 100	Charcoal	Beta-2286	Gilmore et al. 1999; Morris et al. 1985
Phoebe Rockshelter	5LR161	Level 3	D/H	3570 +/- 60	Charcoal	Beta-3869	Gilmore et al. 1999; Thompson 1986
Phoebe Rockshelter	5LR161	Level 3	D/H	3890 +/- 60	Charcoal	Beta-3870	Gilmore et al. 1999; Thompson 1986
Rock Creek site	5BL2712	Feature 20	D	3120 +/- 190	Charcoal	Beta-71550	Gilmore et al. 1999; Gleichman and Phillips 1995
Rock Creek site	5BL2712	Feature 22	D	3000 +/- 190	Charcoal	Beta-68172	Gilmore et al. 1999; Gleichman and Phillips 1995
Swallow site	5JF321	Feature 17	D/L,mixed	3440 +/- 90	Charcoal	Beta-44398	Gilmore et al. 1999; Rathbun 1991
Swallow site	5JF321	Feature 107	D/L/mixed	3150 +/- 100	Charcoal	Beta-42288	Gilmore et al. 1999; Rathbun 1991

Legend: H = Hanna, D = Duncan, L = McKean Lanceolate, M = Mallory, mixed = other cultural association

5.7.2 Site Descriptions

5.7.2.1 Sites in the Southern Rockies

The Kinney Spring site (5LR144) is a campsite occupied from Early Archaic to Early Ceramic times. Diagnostic projectile points include McKean Complex points and a Mallory point. Features included hearths. In Stratum 4 Duncan and Hanna points were recovered. A single hearth was unearthed with radiocarbon dates taken. In Stratum 3 Mountain Complex artifacts were found mixed with a McKean Lanceolate point. Faunal remains include elk or bison, freshwater mussel, and unidentified bone (Gilmore et al. 1999). No floral remains were reported.

Pack Rat Rockshelter (5LR170) is a sheltered camp overlooking Spring Gulch. The site has been occupied from Early to Late Archaic times. Projectile points include Duncan, Hanna, and Mallory. Artifacts include projectile points, other lithic tools, ground stone, fleshing tools, and bone awls. Much of the stone tools were made of local quartzite (Gilmore et al. 1999). No floral remains were reported.

Lunch Cave (5LR188) is a sheltered multicomponent camp occupied during the Middle Archaic and Late Prehistoric. Unearthed at this site were hearths and an associated Hanna projectile point (Gilmore et al. 1999). No floral remains were reported.

The LoDaiska site (5JF142) is a sheltered camp located beneath a west-facing outcrop overlooking Strain Gulch. The McKean component is interpreted as a base operations site. The site was occupied from Early Archaic to the Early Ceramic Periods. In Complex C, many Duncan projectile points were identified. Some McKean Lanceolate points were excavated but they are smaller than those from the McKean or Signal Butte Sites. Features included large hearths filled with stones. Faunal remains were dominated by mule deer. Artifacts include scrapers and utilized flakes, bone beads, paint stones (hematite and limonite), metates, and manos. Floral material included acorns, sedges, and chenopods. Activities at this site would have included hide processing, hunting and gathering, and food processing (Gilmore et al. 1999).

Dancing Pants (5DA29) is a multicomponent shelter site in the foothills on the east bank of the South Platte River. The site was occupied during the Early Archaic, Middle Archaic, and Late Prehistoric Periods. The site contains McKean Lanceolate and Duncan/Hanna projectile points. A single slab lined hearth was also recovered. Artifacts include flakes, bone, ground stone fragments, and projectile points. Faunal remains are predominately deer. Macroflorals include

conifer, dicotyledon, pine, fir, dandelion, grasses, mallow and vegetal foods. Also found were two posthole elements of a lean-to (Gilmore et al. 1999).

The Spring Gulch site (5LR252) is a multicomponent open camp at the bottom of Spring Gulch. McKean levels included Mallory, Duncan, and Hanna points in levels II-IV. Radiocarbon dates indicate that there were mixed deposits. Artifacts include projectile points, bifaces, choppers, scrapers, spokeshaves, drills, gravers, burins, flakes, cores, awls, and needles. Faunal remains included high numbers of bison and mule deer. Other animal remains include jackrabbit, cottontail, bobcat, pocket gopher, vole, wood rat, red tailed hawk, western painted turtle, and clams. Plant remains included charred goosefoot seeds (Gilmore et al. 1999).

The Ken Caryl Ranch sites are sheltered by the Fountain formation sandstone monoliths. These sites are attributed to a single technological tradition (Larmore 2002:35). Sites include the Swallow site (5JF321), Falcon's Nest (5JF211), Bradford House II (5JF51), Crescent and Colorow Cave. The Swallow site contained several hundred projectile points from all time periods, including McKean diagnostics, Duncan and McKean Lanceolate. There was much mixing of deposits and no vertical provenience of projectile points. Dated features include a rock lined hearth at 3150 +/- 100 BP (Feature 107) and a primary flexed interment of an individual at 3440 +/- 90 BP (Feature 17). Falcon's Nest is a sheltered camp occupied during the Middle Archaic, Late Archaic, and Early Ceramic. Diagnostics of the Middle Archaic levels include type MM3 and Duncan projectile points. Faunal studies show that deer was the primary source of food. Artifacts distributed through all the layers include knives, scrapers, gravers, projectile points, cores, flakes, choppers, and ground stone implements. Bradford House II is a small rockshelter occupied from Middle Archaic to Historic times. A radiocarbon age of 3255 B.P. was recovered from a slab lined hearth associated with Duncan points. Other projectile points associated with this site include MM3, McKean Lanceolate, Hanna, and Mallory. Faunal remains include mule deer, rabbit, and bison. Two hearths, one associated with a McKean point was uncovered at Crescent Rockshelter. Colorow Cave contained a Duncan or MM6 projectile point (Gilmore et al. 1999). No floral remains were reported.

Draper Cave (5CR1) is a rockshelter site occupied from the Archaic Period to the Ceramic Period. There was much mixing among levels. Two radiocarbon ages of 3520 B.P. and 3480 B.P. were obtained from arbitrary levels. Features include cobble lined and slab lined hearths as well as a male burial. McKean projectile points include McKean Lanceolate, Hanna,

and Duncan points. Raw lithic material included a variety of source from various distances up to 100 km (Gilmore et al. 1999). No floral remains were reported.

Site 5WL40 is a sheltered campsite near the Pawnee Creek. Artifacts include a Hanna projectile point, a stemmed, cancave base fragment, an ovate blade fragment, an endscraper, retouched flake, a mano, and debitage. Raw material was petrified wood. The Wilbur Thomas Shelter (5WL45) contained two McKean levels. Artifacts include long lanceolate blades, Hanna, and Duncan points. Tools include end scrapers, knives or scrapers, flakes, and spokeshaves. Considerable mixing was evident with Mountain Complex projectile points, and Woodland points in the McKean levels. Site 5WL48 is a campsite located on a stabilized dune looking over the South Platte River. Recovery was meager and parts of the site were destroyed. The site is represented by Duncan points. A sample from a hearth produced a radiocarbon age of 3230 B.P. (Gilmore et al. 1999). No floral remains were reported.

5.7.2.2 Sites in the High Plains

Dipper Gap (5LO101) is located on a butte overlooking the Dipper Valley. The McKean component of this base camp was identified by diagnostic projectile points including Hanna and Duncan points, though Duncan points are atypical. Tools found at the site include cores, knives, scrapers, drills, gravers, perforators, manos, metates, shaft abraders, grooved cobbles, hammerstones, bone awls, scraping tools, a bone bead, and gaming pieces. Tools were made of mostly local flattop chert. The site was occupied from Archaic to Late Prehistoric times. Faunal remains include bison, pronghorn, and canid bone. This site is described as a seasonal base camp. Radiocarbon dates from Locality 1, Zone D include 3180 B.P., 3410 B.P., and 3520 B.P. (Gilmore et al. 1999). Floral remains were not reported.

The Rock Creek site (5BL2712) is an open habitation site on the northern flank of Rock Creek (Gilmore et al. 1999). This site was occupied from Early to Middle Archaic times. Stratum C contained the McKean diagnostics. Artifacts include projectile points, bifaces, an atlatl weight, drill, a mano, and flakes. Features include basin shaped hearths and a hearth dump. Plant species found in the hearths include pigweed, goosefoot, bulrush, and cocklebur seeds. Faunal remains are from medium large animals with more emphasis on smaller animals including birds and prairie dog. Bone fragmentation and choice indicate probably bone grease manufacture. Radiocarbon ages are 3120 B.P. and 3000 B.P. (Gilmore et al. 1999).

5.7.2.3 Sites in the Southwestern Tablelands

The Bayou Gulch site (5DA265) is a multicomponent campsite at the confluence of Bayou Gulch and Cherry Creek. The site was occupied from Early Archaic to Protohistoric time. McKean Lanceolate, Hanna, Duncan and Mallory points are associated with the McKean components. Features include basins with or without rocks. Tools include projectile points, bifaces, drills, flakes, manos, metates, grooved stones, and paint palettes. Stone tools were made mostly of local materials. A bone bead was also recovered. A radiocarbon date from feature 14 of 3410 B.P. was obtained (Gilmore et al. 1999). Floral remains were not reported.

5.8 North Dakota Sites

5.8.1 Introduction

Within North Dakota sites examined in this thesis are located within two ecoregions: the Aspen Parkland/Northern Glaciated Plains and the Northwestern Great Plains. In North Dakota McKean sites are recognized by the presence of McKean Lanceolate, Duncan, Hanna, or Mallory projectile points. There are few McKean sites with associated radiocarbon dates and projectile points. These sites date between 3550 – 4030 B.P. and are associated with Duncan projectile points. As of 2008, 209 McKean sites were registered with the SHIPO office. In North Dakota sites are more prevalent in the west to southwestern portion of the state. Sites include base camps, processing locals, and procurement sites (Gregg et al. 2008).

Through an examination of the North Dakota Comprehensive Plan for Historic Preservation (Gregg et al. 2008) some general trends were observed. Many of the sites that were identified as being McKean are surface finds of projectile points and other artifacts. Suggested settlement patterns in areas such as the Badlands include a core territory that was used by a local group where there is a long-term base camp surrounded by smaller field camps. A similar pattern has also been noted by Keyser and Davis (1984) in the Lightning Spring Site.

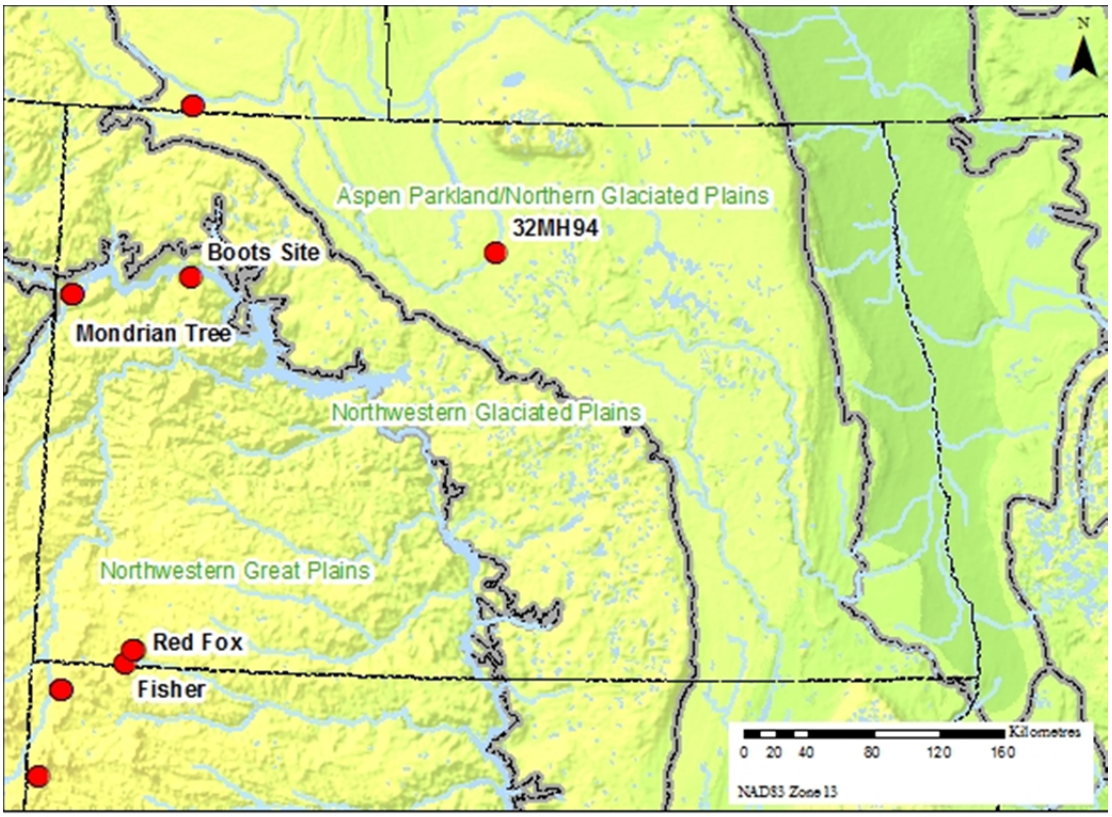
Faunal remains from the sites are primarily bison or large ungulates. Plant remains were associated with the Boots site suggesting the utilization of plants for subsistence. McKean features include a possible pit house, hearths, rock lined pits, and roasting pits. Hearths and roasting pits also suggest plant processing (Keyser and Davis 1984). Materials used for lithic tool manufacture were often locally obtained, though obsidian source testing showed that material

was procured from "Obsidian Ridge in Wyoming" indicating interactions with areas in the Rocky Mountains (Sappington 1984).

Table 5.7 Radiocarbon Ages of North Dakota McKean Components

Site Name	Site #	Context	Associated Points	Date B.P.	Material	Lab No.	Source
Mondrian Tree	32MZ58	Area A - Zone 7	D	3550 +/- 85	Charcoal	UCR-1324	Toom and Gregg 1983
Mondrian Tree	32MZ58	Area A - Zone 7	D	3560 +/- 170	Charcoal	UCR-1326	Toom and Gregg 1983
Mondrian Tree	32MZ58	Area A - Zone 7	D	3580 +/- 170	Charcoal	UCR-1325	Toom and Gregg 1983
Mondrian Tree	32MZ58	Area A - Zone 7	D	3745 +/- 170	Charcoal	UCR-1323	Toom and Gregg 1983
Mondrian Tree	32MZ58	Area A - Zone 7	D	4030 +/- 100	Charcoal	UCR-1322	Toom and Gregg 1983
Red Fox	32BO213	Level 4 east	D	3770 +/- 90	Charcoal	SI-479	Syms 1969

Legend: D = Duncan



(CEC 2011; ESRI 2008; Floodman et al. 1997; Keyser and Davis 1985; Stine et al. 2001; Syms 1969; Toom 1983)

Figure 5.7 North Dakota Sites Associated with the McKean Complex

5.8.2 Site Descriptions

5.8.2.1 Northwestern Great Plains

The Red Fox site (32BO213) is a small campsite located on Spring Creek within the Grand River Drainage (Keyser and Davis 1985:123; Syms 1969). It is a deeply stratified multicomponent site. Level 4 had a Duncan projectile point with a radiocarbon date of 3770 B.P. Features found at this site include a storage pit, hearths, and a possible house pit. The fire pits are circular and shallow, have a rock bottom, and are conical in cross-section. The Duncan projectile points are similar to those at Lightning Spring and the Duncan-Hanna points at the McKean Site (Davis and Keyser 1999:253). Artifacts include projectile points, debitage, blanks, preforms, and flakes. No ground stone or bone tools were recovered. Faunal remains include crushed bison bone. Local petrified wood was used for lithic artifacts. Keyser and Davis (1984) interpret this site as having a focus on processing and procurement. No floral remains were reported.

The Mondrian Tree site (32MZ58) is located on the south bank of the Missouri River approximately 6.5 kilometres from the confluence of the Missouri and the Yellowstone Rivers. The site was occupied intermittently over the last 5000 years including Historic, Late Prehistoric, Pelican Lake, Besant, Avonlea, and Middle Archaic. McKean component is Area A: Zone 7 and is comprised of a Duncan projectile point and five radiocarbon dates. Artifacts include a projectile point fragment, FCR, and flaking debris. The faunal assemblage includes large canids, wapiti, deer, bison, and unidentified ungulates. This site does not have grinding stones associated with it. Stone material is local, with Knife River Flint. Features include surface hearths and a hearth pit (Toom and Gregg 1983). No floral remains were reported.

Fisher site (32BO207) is a stratified site located on the North Fork of the Grand River. The site contained five cultural components. Occupation Zones 1-3 are unidentified Occupation Zones. Occupation Zone 4 contained projectile points of the McKean Complex as well as rock lined fire pits. A McKean Lanceolate point is associated with Occupation Zone 4 (Syms 1969:136). Two bone awls were recovered from this level. (Syms 1969:136). Occupation Zone 5 contained a Box Elder point (Syms 1969).

The Boots site (32MZ732) is located on a small bench overlooking the Missouri River valley. This site contained occupation from the Early Archaic to Historic times. Duncan and Hanna projectile points are associated with this site. Level 4 contained a Duncan projectile point.

Artifacts in Level 4 include projectile points, bifaces, retouched flakes, utilized flakes, scrapers, cores, a hammerstone, and debitage. Level 3 contained Pelican Lake and late Prehistoric points. Artifacts in level 3 include projectile points, scrapers, a core, bifaces, retouched flakes, utilized flakes, pottery, and debitage. Features included oxidized burnt earth, and a basin shaped hearth. Prickly pear may have been processed. There was much mixing of the levels at this site due to a historic basement dug on the site and historic artifacts can be found in some of the prehistoric levels (Floodman et al. 1997).

5.8.2.2 Aspen Parklands/Northern Glaciated Plains

Site 32MH94 is located in the Souris Basin overlooking the Souris River Valley (Stine et al. 2001:41, 251). Four components were found at the site (Stine et al 2001:271). Syms (1969) suggested that settlement in this region was by small groups that lived together for most parts of the year and aggregated with other groups for seasonal bison hunting activities. This site may represent a small field campsite (Stine et al. 2001:251). Levels associated with the McKean Complex include Levels 7 and 8 in Block 3 and Level 9 in Block 5. Block 3, Levels 7 and 8 contained three Duncan points. Other artifacts associated with these levels include bifaces, an ovoid fragment, flake tools, end scraper, core and core tools. Faunal remains recovered included bison or wapti and unidentifiable bone. A burned earth feature was associated with Level 8, though it was not determined whether this was a cultural feature or not. In Block 5, Level 9 a McKean Lanceolate point was recovered as well as unidentifiable projectile point ear fragments. This level also contained much FCR. Faunal remains include bison and wapiti or bison. These levels suggest that hunting, butchering, hide working, tool manufacture, and bone working occurred at this site. Materials used in stone tool manufacture are mostly Knife River Flint (~50%) while the rest are mostly other local materials (Stine et al. 2001:250-252). No floral remains were reported.

5.9 South Dakota Sites

5.9.1 Introduction

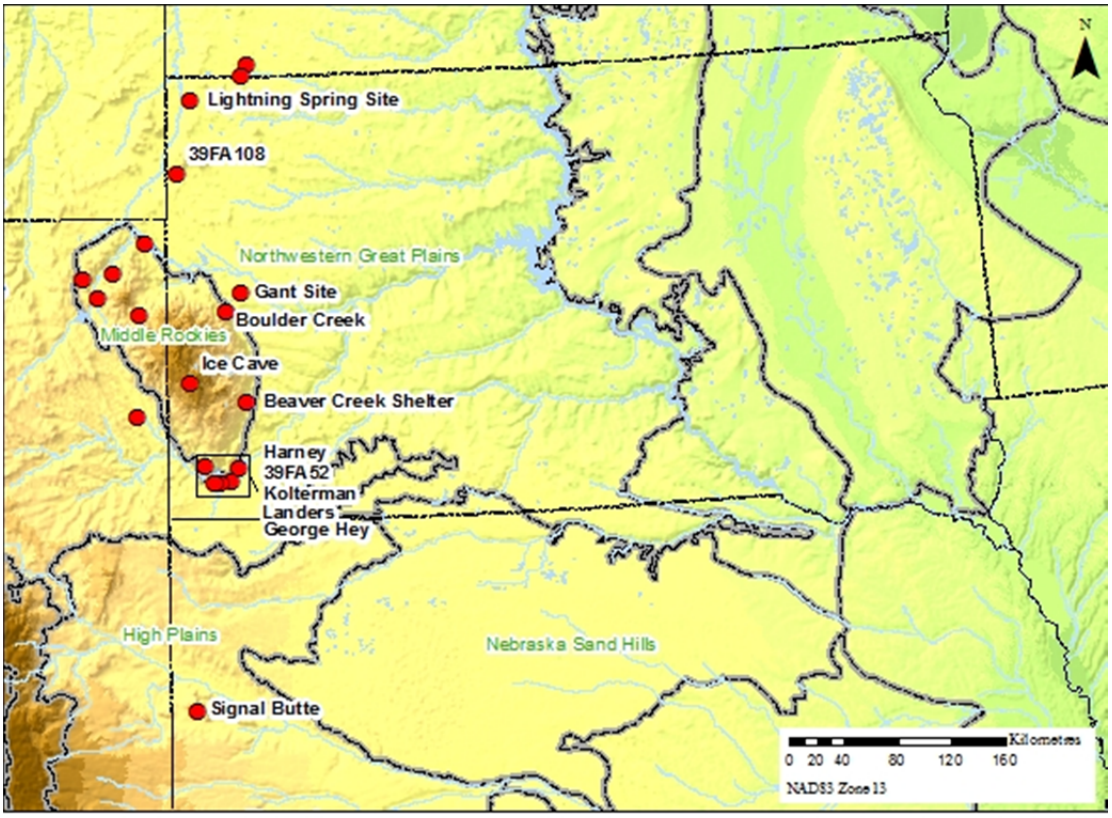
The South Dakota sites examined in this thesis are located in two ecoregions: The Northwestern Glaciated Plains and the Middle Rockies. The Black Hills are associated with the

Middle Rockies Ecoregion. Dates for the McKean occupation in South Dakota ranges from approximately 4200 – 3600 BP. Sites are located in greater numbers near the western border and lessen to the east. Most of the McKean sites are located west of the Missouri River. This sites in the Black Hills area are larger and more numerous suggesting longer or more frequent occupation (Frison 1991).

Table 5.8 Radiocarbon Ages of South Dakota McKean Components

Site Name	Site #	Context	Associated Points	Date B.P.	Material	Lab No.	Source
Beaver Creek Shelter	39CU77	Unit 11	L	3870 +/- 70	Charcoal	Beta-13827	Tratebas 1998
Beaver Creek Shelter	39CU77	Unit 13	L	4010 +/- 100	Charcoal	Beta-19060	Tratebas 1998
Gant Site	39ME9	Unit III	D/H/L/mixed	4130 +/- 130	Charcoal	n/a	Keyser and Davis 1999
George Hey	39FA30	Feature 6	D/L	3520 +/- 70	Charcoal	WIS-1086	Tratebas 1998
George Hey	39FA30	Feature 9	D/L	3925 +/- 65	Charcoal	WIS-1065	Tratebas 1998
Kolterman	39FA68	Component B	L	3630 +/- 175	Charcoal	M-368	Wheeler 1995a
Kolterman	39FA68	Component B	L	4230 +/- 175	Charcoal	M-369	Wheeler 1995a
Lightning Spring site	39HN20	Stratum 8	D	3430 +/- 270	Charcoal	TX-4084	Keyser and Davis 1999
Lightning Spring site	39HN20	Stratum 9	D	4190 +/- 110	Charcoal	TX-4083	Keyser and Davis 1999
Lightning Spring site	39HN20	Stratum 10	D	3850 +/- 150	Charcoal	TX-4081	Keyser and Davis 1999
Lightning Spring site	39HN20	Stratum 10	D	3870 +/- 210	Charcoal	TX-4082	Keyser and Davis 1999
Lightning Spring site	39HN20	Stratum 12	D	4040 +/- 90	Charcoal	Beta-58280	Keyser and Davis 1999
Lightning Spring site	39HN20	Stratum 14	D	4200 +/- 170	Charcoal	Beta-58279	Keyser and Davis 1999

Legend: H = Hanna, D = Duncan, L = McKean Lanceolate, mixed = other cultural affiliation



(Boen 2013; CEC 2011; ESRI 2008; Forbis 1985; Keyser and Davis 1984; 1999; Tratebas 1998; Wheeler 1995a)

Figure 5.8 South Dakota Sites Associated with the McKean Complex

5.9.2 Site Descriptions

5.9.2.1 Sites in the Northwestern Glaciated Plains

The George Hey site was a winter camp located in the southern Black Hills. The site is sheltered by high knolls and sandstone outcrops. Grinding stones are present. Features include burnt rock middens, single use hearths, and circular, basin shaped hearths (rock lined or charcoal filled). The faunal remains where highly fragmented with some identified as deer. Projectile points included McKean Lanceolate, Duncan, and Hanna. Floral remains include *Atriplex* and *Gramineae* sp. (Tratebas 1998).

The Lightning Spring site is a multicomponent site in the North Cave Hills in a small sheltered basin (Keyser and Davis 1985:123). Levels 8 through 11 were associated with Duncan points. Radiocarbon ages were taken from four hearths in levels 8, 9, and 10. Artifacts include projectile points, manos, a milling slab, cutting and scraping implements. Stone tools are made of

local materials. Faunal remains include bison, deer, antelope, mountain sheep, canid, and a variety of birds and small mammals (Keyser and Wettstaed 1995:2). Pronghorn was predominant in three of the McKean levels. Charred floral remains and carbonized seeds were recovered from hearths. Species include *Chernopodium* sp. (*Rumex* sp. or *Polygonum* sp.), *Compositae* sp., and *Gramineae* sp. families. One of the Compositae seed resembles a flower seed from the Middle Missouri Villages (domestic sunflower). Hearths were shallow and round or conical and rock filled. Radiocarbon ages range from 4200 – 3430 B.P. (Keyser and Davis 1985).

The Kolterman site (39FA68) is located in the South Fork Cheyenne region. Component B of this site was identified as a McKean component based on McKean Lanceolate, Duncan/Hanna, and a Kolterman projectile point as well as radiocarbon ages of 3630 B.P. and 4240 B.P. This level contained platform hearths as well as larger stone-lined basins. Stone tools included knives, scrapers, flake tools, choppers, a shaft cutter, manos, chipped stone debris, and a grooved cobble. Bone awls and a bone bead were also uncovered. Faunal remains include white tailed deer, cottontail, pocket gopher, and bison (Wheeler 1995a:265-284). No floral remains were reported.

The Harney site (39FA10) is located on a grass covered canyon terrace. Component A was associated with a McKean point as well as small and large stemmed points. Features included prepared hearths, a charcoal stained sand lens, stone lined, basin shaped hearths, a stone filled jar shaped hearth, a pit hearth, and other stone hearths. Artifacts associated with this component include cores, bifaces, unifaces, projectile points, knives, endscrapers, flake scrapers, a scraper drill, hammerstones, utilized flakes, a palette, a smoothing stone, a milling slab, a hand stone, a modified bone, and a lump of hematite. Faunal remains include bison and a shell fragment. Component B was associated with a Duncan point, a McKean Lanceolate point, as well as small and large stemmed points. Features include a charcoal stained lens, a stone hearth, and a stone cluster. Artifacts include projectile points, knives, a hand drill, a drill point, end scrapers, side scrapers, flake scrapers, a utilized flake, and a hand stone. Faunal remains include bison and Blacktail prairie dog (Wheeler 1995a:307-315). Component C is associated with Harney, Duncan, McKean, and small and large stemmed points. Features include a charcoal stained lens, stone lined saucer shaped hearths, stone line basin shaped hearths, stone platform hearths, a stone hearth, and stone clusters. Artifacts include projectile points, knives, a drill point, end scrapers, a bow shaft cutter, an arrow shaft cutter, flake scrapers, utilized flakes, choppers, a

hand hammer, milling slabs, a milling basin, hand stones, and a bone awl. Faunal remains include bison and Blacktail prairie dog (Wheeler 1995a).

The Landers site (39FA54) is a short-term hunter-forager campsite with diagnostic Duncan/Hanna projectile points. Artifacts at this site include cores, knives, an end scraper, flake tools, chippers, engravers, a shaft cutter, manos and metates, a bone die, a sharpening stone, and hematite. Faunal remains include bison and deer or pronghorn. Other surface finds in the area associated with the McKean Complex include artifacts such as projectile points, knives, end scrapers, flake scrapers, hammerstones, choppers, manos and metates, cores and chipping debris. A variety of local materials were used (Wheeler 1995a).

Site 39FA52 is located on a high ridge above a spring. This site is designated as the Early Stage of the Middle Prehistoric Period based on a Hanna like point. Artifacts included a projectile point, many flakes, burned rocks, manos, metates, hammerstones, anvil stones, milling stones, cores, flakes, an endscraper, flake uniface tools, and bifaces (Boen 2013).

The Gant site (39MD9) is a single component site that contains McKean Lanceolate, Duncan, Hanna, and Oxbow projectile points. Tools included knives, scrapers, drills, spokeshaves, manos, metates, and hammerstones. Grinding stones were recorded in association with McKean diagnostic points. This site was interpreted as a seasonal camp for plant processing and tool manufacture. Radiocarbon dates include 4130 B.P., 3620 B.P., and 3650 B.P. Other artifact associations include the Oxbow Complex (Davis and Keyser 1999; Gant and Hurt, Jr. 1965).

5.9.2.2 Sites in the Middle Rockies

The Boulder Creek Shelter (39CU779) is located in a small overhang in the northern Black Hills (Donahue et al. 1995 in Tratebas 1998:279). The McKean occupation was located 100 to 130 cm below the surface. A total of five occupations were discovered. The McKean occupation included a McKean Lanceolate point, scrapers, a biface, retouched flakes, and debitage. Features included basin shaped hearths, and a midden of flakes. Faunal analysis was not completed though there were bone fragments present. This site was repeatedly reoccupied as indicated by the superposition of the hearths (Tratebas 1998:279). This was likely a winter site due to its sheltered location (Tratebas 1998:279).

Ice Cave (39PN326) was identified as having McKean diagnostics. This site is located in a high elevation limestone cave (Tratebas 1998:280). Both Duncan and McKean Lanceolate points were found (Styles 1994 in Tratebas 1998:280). Faunal remains include bison, elk, rabbit, and deer bones. Fetal deer bones suggest a spring occupation (Tratebas 1998:280).

The Beaver Creek Shelter (39CU779) is a rockshelter site in the southeastern Black Hills (Tratebas 1998). The site contained 17 occupation levels dating between the Early and Middle Archaic. Between 4710 B.P. and 3870 B.P. there were a series of McKean occupations. McKean Lanceolate points were found in three of these occupations. Artifacts included bifaces, flake tools, and debitage (Tratebas 1998:279). Principal activities at the site include production and maintenance of stone tools, hunting, and processing. The Middle Archaic level contained roasting pits and hearths. The Hanna point is located stratigraphically higher than the McKean Lanceolate. Faunal remains include deer, bison, pronghorn, canids (including domesticated dog), rabbits, and toads (Alex 1991; Martin et al. 1993). This was likely a warm season occupation (Tratebas 1998:279).

5.10 Nebraska Sites

5.10.1 Introduction

A single site, Signal Butte (25SF1), was examined in this thesis within the boundaries of Nebraska. This site is located in the High Plains Ecoregion. A map of this site location can be found in Figure 5.9. This site contains both McKean Lanceolate and Hanna projectile points. The site produced radiocarbon ages between 4170 and 4550 B.P. The Signal Butte site is described in section 5.10.2.1.

Table 5.9 Radiocarbon Ages of Nebraska McKean Components

Site Name	Site #	Context	Associated Points	Material	Date B.P.	Lab No.	Source
Signal Butte	25SF1	IC	H/L	Charcoal	4170 +/- 250	L-385D	Forbis 1985
Signal Butte	25SF1	1A	H/L	Charcoal	4550 +/- 220	L-385B	Forbis 1985

Legend: H = Hanna, L = McKean Lanceolate

5.10.2 Site Description

5.10.2.1 Site in the High Plains

Signal Butte is located in western Nebraska. This site contained stemmed, McKean Lanceolate and large side-notched points. McKean radiocarbon ages of 4550 B.P. and 4170 B.P. were obtained (Frison 1991:101). Signal Butte I (lower layer – Strata I) can be further subdivided into 1A, 1B, and 1C, but artifacts recovered from the excavation only distinguished between Strata I and II (Bliss 1950; Forbis 1985). McKean Lanceolate and Hanna projectile points occur in both Strata I and II. Artifacts associated with Strata I include drills, gravers, projectile points, shaft smoothers, pebble hammerstones, a stone axe, manos, bone tubes, and gaming pieces. Features include pits, hearths, and stone lined hearths. The location, butte top, is not close to water or wood but has a commanding view of the Plains (Forbis 1985:28). No floral remains were reported.

Chapter 6: Methods and Results

6.1 Introduction – GIS and Archaeology

Geographical Information Systems (GIS) are a tool used to understand spatial information (Conolly and Lake 2010). Though rooted in cartography, using GIS is not only about creating maps, but has broad implications in helping to understand spatial relationship in natural and anthropogenic data (Couclelis 1999). Archaeologists are interested in the understanding of the spatial organization human behaviour left behind through the material remains and GIS allows us to examine these phenomenon at all scale levels. It also helps compile, organize, and make sense of large amounts of data.

This chapter will describe the methods used in this research as well as background information used to create the methods. First, a background on the use of radiocarbon ages to examine spatio-temporal trends that have been conducted in archaeology will be discussed. This is followed by an overview of geostatistics and the geostatistical method that was used, then a short discussion on radiocarbon dating and the potential limitations and issues concerning the dataset. This will be followed by the methods used in creating the prediction model, including the data collection, building of the database, building and testing of the model, and querying of the database.

6.2 Spatiotemporal Analysis in Archaeology

This research will attempt to better understand geographic patterns reflected by the McKean Complex site locations and radiocarbon ages. The utilization of GIS software to perform these examinations has become instrumental in the interpretation and understanding of past cultures (Boaz and Uleberg 2000:101-115, Bove 1981:93-112, Harris 2000:116-123, Kornfeld et al. 2010:330-335, Kvamme 1990:197-207, Llobera 1999:65-84). Radiocarbon data have been used for spatial analysis in archaeological research to examine migrations, origins, the spread of innovations, and the interaction of cultures. Examples of these investigations include an examination of the movement of cultures across North America (Collard et al. 2010; Hamilton and Buchanan 2007; Hazelwood and Steele 2004), the collapse of the Classic Maya (Bove 1981; Kvamme 1990), the spread of agriculture through Europe (Ammerman and Cavalli-Sforza 1971; Bocquet-Appel et al. 2009), the Neolithic transition in Europe (Ammerman and

Cavalli-Sforza 1984; Gkiasta et al. 2003), the interaction between *Homo sapiens* and Neanderthals (Bocquet-Appel and Demars 2000), the distribution of the Oxbow Complex (Spurling and Ball 1981) and movement of the Central Plains Tradition (Roper 1976). What follows is a brief overview of research topics using techniques that will be followed in this thesis.

Bocquet-Appel and Demars (2000) used Kriging and radiocarbon ages to explore the relationship between Neanderthals contraction and early human colonization in Europe. They examined the youngest radiocarbon ages of Neanderthals and the oldest of modern humans to examine the geographical continuum of the dates. They were able to see the retraction of the Neanderthal population, the spread of modern humans, and a space-time estimate of where Neanderthals and modern humans coexisted.

Gkiasta et al. (2003) published a paper on the Neolithic transition in Europe through the examination of Mesolithic and Neolithic sites and their associated radiocarbon ages. They found that there was an overall diffusion into Europe from the southeast. There were able to examine local variation and found that in some areas the change happened quickly and one population replaced another. In other locations the change was gradual and was due to diffusion of ideas rather than the movement of people.

Bocquet-Appel et al. (2009) examined the diffusion and contact zones of early farming in Europe through the examination of the space-time distribution of radiocarbon ages. Using Kriging they were able to examine the expansion of early Neolithic sites, determine centres of renewed expansion, and detected the main routes of expansion. There was not a steady homogeneous diffusion, but rather an expansion marked by phases of expansion and stasis.

The spatiotemporal dynamics of the Clovis-Folsom transition was investigated using radiocarbon ages to examine where Folsom originated, how Folsom spread (demic or cultural diffusion), and the speed of the Clovis-Folsom transition (Collard et al. 2010). By examining correlation coefficients they found that Hell Gap was the likely the location of origin and that Folsom sites are generally older in the north than in the south.

6.2.1 Geostatistics

Geostatistical techniques are used to characterize spatial variation, generate predictions and simulations, and provide optimization. Geostatistic methods are based on the principle of spatial autocorrelation; items located closer together are more related than those further apart

(Lloyd and Atkinson 2004). It uses both statistics and mathematical methods to create a model (surface) and assesses the prediction uncertainties. It takes sample locations and creates a continuous surface. In this case, the sample is measuring a phenomenon, radiocarbon ages, and derives a surface based on the values at the measured location to predict values at unknown locations.

Geostatistics relies on the theory of regionalized variables, which is a method used to interpolate points in space. When determining values at unknown locations it becomes necessary to allow for uncertainty in the prediction. The variogram, the core tool of geostatistics is used to examine spatial variation in the dataset. The variogram is estimated through "calculating the squared differences between all the available paired observations and obtaining half the average for all observations separated by that lag (Lloyd and Atkinson 2004:153)". A mathematical model is then fit to the variogram and the coefficients used for geostatistical operations (Lloyd and Atkinson 2004).

6.2.2 Kriging Interpolation Technique

The software used in this research was ArcGIS 10.2.2.3552 Desktop. Components of the ArcGIS suite used included ArcMap, the main component of the geospatial suite, and the Geostatistical Analyst extension. Kriging is a statistically based estimator of spatial values used to analyze and predict values that are associated with spatial phenomena (Bolstad 2008). There are three components to Kriging interpolation: the spatial trend, the local spatial autocorrelation, and the random variation (Bolstad 2008). Kriging uses statistically chosen weights of values to create predicted values in between the known values.

Kriging is similar to the inverse-distance weighting method where it uses a variable to weight the influence of surrounding values, based on the distance they are apart, to predict values in the unsampled locations (Conolly and Lake 2010). In Kriging, the weighted value is dependent on two factors, spatial structure and the degree of spatial autocorrelation in the distribution of the sample (Conolly and Lake 2010). This method uses variograms to predict the influence of distance on the relationship between known values and fits this to a theoretical model. Kriging uses regionalized variable theory by establishing a relationship between distance and attribute variability (Conolly and Lake 2010).

Further, Kriging uses lag distances, the distance between two points as calculated from the x and y coordinates for the sample points. So each set of points is separated by a distance (lag distance) as well as a difference in values, in this case the difference between radiocarbon ages. Lag distances are associated with lag tolerance, the range on either side of the lag distance. This defines a range for the grouping of samples and helps with the estimation of the spatial covariance (Bolstad 2008).

To represent the spatial covariance a variogram or a semivariogram is used to examine the semivariance in relation to lag distance. A semivariogram plots the spatial autocorrelation of a variable. This chart will show a plot of the calculated semivariance against the model surface or model fit semivariance.

Spatial prediction is one application of the variogram model. The most widely used model is when optimal weights are used for prediction. An optimal weight means that they minimize the amount of error in a prediction and they are unbiased. Kriging uses a minimum variance method to calculate weights and as a result may be more precise than other interpolation techniques (Bolstad 2008).

There are different techniques that can be applied to the model depending on type of data:

- Simple Kriging – for datasets where the mean of the property of interest is known and modelled as a constant across the study area. In practice this rarely happens (Lloyd and Atkinson 2004)
- Ordinary Kriging - the mean is allowed to vary spatially and is estimated for each prediction neighbourhood. It uses weighted averages of the distances between points (Lloyd and Atkinson 2004)
- Universal Kriging – uses trend surface information but still uses local values. Data has a definite trend (Conolly and Lake 2010).

When attempting to model the geographical expansion of a biological or cultural phenomenon, Kriging often works well (Chiles and Delfiner 1999; Wackernagel 1998). It is able to display the data in a space-time structure as a continuum through a prediction surface (Conolly and Lake 2010). This method of analysis was chosen because the Kriging interpolation technique is able to take into account information redundancy at a single geographic location. As well, if there is no systematic direction bias (random) in the standard deviations of the radiocarbon ages across the area being examined then the trends in the data can be correctly

modeled (Bocquet-Appel et al. 2009). This method also provides information concerning errors in the model concerning the predictions made.

6.3 Radiocarbon Dating

Carbon-14 (C-14) is a radioactive isotope that occurs in nature. Carbon occurs in all organic compounds. During the lifetime of an organism the amount of C-14 remains the same in the tissues, but once the organism dies the C-14 declines at a rate known as a half-life. Libby calculated the half-life of carbon-14 to be 5568 +/- 30 years. Subsequent research has found that the half-life of C-14 is 5730 +/- 40 years. For clarity, radiocarbon laboratories continue to use the half-life that Libby originally calculated. To be dated reliably an organic sample must be between 50,000 and 100 years. Counters typically measure the C-14 content by monitoring the rate of decay per unit time. Accelerator mass spectrometers (AMS) directly counts the number of C-14 atoms (Morlan n.d.).

Radiocarbon dates are expressed with an uncertainty of one standard deviation, which means that there is about a 67% chance that the age of the sample falls within the stated range. This uncertainty takes into account variability such as background radiation that varies through time and geographically. Two laboratories, the University of Waterloo and the Geological Survey of Canada, report radiocarbon ages with a 2-sigma error (approximately 95% probability) (Morlan n.d.).

Ages are calculated in years before present (B.P.). An international convention established that the year of A.D. 1950 would be used as a reference point. Because radiocarbon years are not equivalent to calendar years one cannot calculate calendar years by subtracting 1950 from the reported age. For a radiocarbon age to be expressed in calendar years the age must be normalized, calibrated, and corrected for reservoir effects. One problem with radiocarbon dating is that it measures the time since the death of an organism, therefore, evidence of the death of an organism must be directly associated with the cultural activities (Morlan n.d.).

Whether a radiocarbon age needs to be calibrated or not depends on one's purpose. For this thesis we are interested in the relative ages of the dates to one another, not specific ages. Therefore, for this research uncalibrated radiocarbon ages are sufficient.

6.4 Potential Limitations and Issues

There are potential limitations and issues that arise in this type of analysis impacting the results. These limitations include sample size, taphonomic issues, geomorphological impacts, and geographic sampling bias.

This analysis relies solely on the availability of existing data. While every effort has been made to obtain as much information as possible, the sample size remains limited. It appears that the dataset is relatively small relative to the study area and one may question whether the sample size is large enough to identify any patterns or whether it may incorrectly find patterns that do not exist. One method would be to increase data size would include acquiring new radiocarbon dates for new or existing sites, but this is beyond the scope of this thesis. To evaluate the model it will be cross-checked against a subset of radiocarbon dates to examine where the model is most accurate and where problem areas occur.

Taphonomic issues are the result of the processes that affect materials after they have been deposited. Common taphonomic issues include differential preservation and geomorphic processes. Differential preservation is where some organic materials do not preserve and are not found by archaeologists. This is a common problem in the preservation of sites, as materials often preserve well in rockshelters, while in open air campsites they do not. This can impact the ability to acquire radiocarbon dates from materials if none are available. Therefore, there may be fewer sites with radiocarbon dates due to poor preservation. Processes that affect the landscape can also have an impact on the materials in archaeological sites. For example, deflation can cause compression and mixing amongst cultural occupations. Radiocarbon dates associated with mixed levels creates uncertainty in which materials are associated with the radiocarbon dated material.

A bias introduced by the sampling strategy used by researchers also occurs within this study area. On a small scale the sampling strategy used may overlook sites because the methodology used did not include certain regions. This type of bias is also introduced by academic researchers who focus their work in specific areas. In one example, there is an influx of sites in and around Saskatoon as a result of research at Wanuskewin Heritage Park. This area contains a wealth of knowledge about the McKean Complex in a concentrated area. This research also uses data from Cultural Resource Management projects, where work is conducted in response to current economic developments that are taking place. There may be sites in

concentrated areas, but this occurrence is due to high levels of development activities in specific areas and is not necessarily reflective of the overall density of sites in a region. We may see that there are more sites along dam and reservoir developments due to systematic surveys of these locations prior to development. On a map, this may appear that there are many sites in these areas while the surrounding regions have fewer to no sites. This may not be the case, as an absence of sites does not mean that they do not exist, but merely they may not have been identified.

6.5 Methods

6.5.1 Comprehensive Data Collection

A comprehensive database of sites with McKean components within the Study area was constructed. This included sites with or without radiocarbon dates. The sites generally had intact McKean levels that were identified by McKean Complex projectile points. This database was created to provide a comprehensive overview of the McKean Complex in the Study area. Site data was acquired from the published literature as well as from CRM sources. A summary of these sites can be found in Chapter 5. The sites are organized by State or Province and then further subdivided into ecoregions. A total of 96 sites were examined in the study area. The following data was gathered from each site (when available):

- Site location
- Site type
- Environment in relation to the ecoregion in which it is located
- Tools
- Features
- Faunal remains
- Flora remains/analysis conducted
- Radiocarbon date (material, lab #, date)
- Other identifiable archaeological cultures associated with the site

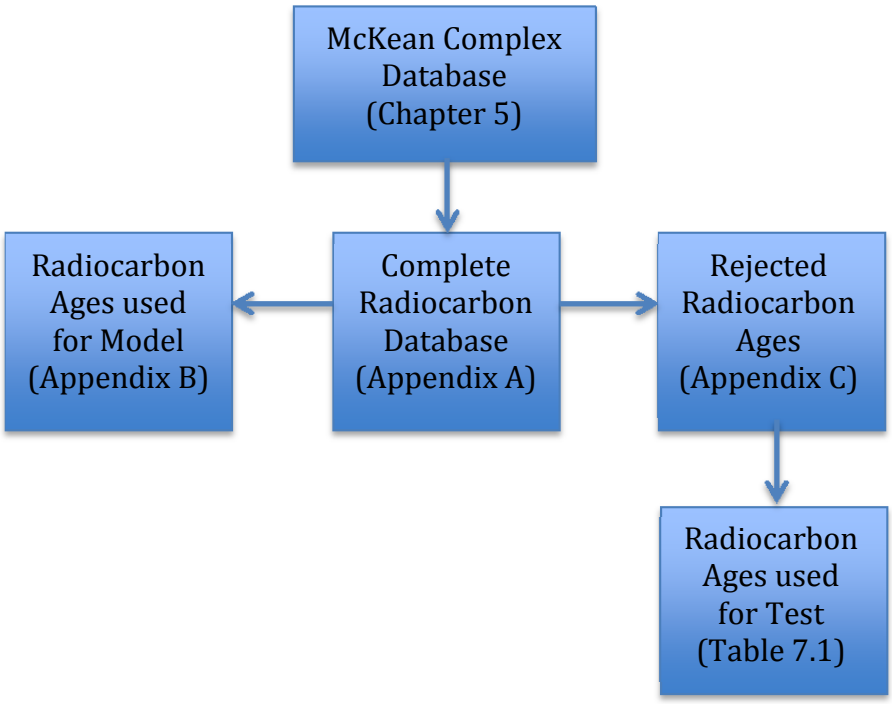


Figure 6.1 Database Creation Flow Chart

6.5.2 Creation of Dataset for Geostatistical Analysis

From the comprehensive database a subset of data was selected of sites that were associated with radiocarbon dates. Radiocarbon dates were acquired through published literature, CARD, SHPO offices in the United States and Provincial Heritage Offices in Canada. In order to get a maximum number of sites both conventional and AMS dates were used.

Initially 140 potential radiocarbon dates associated with 64 georeferenced site locations were compiled (Appendix A). These sites contain at least one radiocarbon date associated with a McKean Complex projectile point. Sites were removed from the database based on the following criteria to create a dataset for the Kriging analysis:

- If the component was mixed (containing projectile points from other cultural groups),
- the standard error was greater than 200 years (Pinhasi et al. 2005),
- the radiocarbon age was out of stratigraphic order,
- the material dated was not identified,
- two types of different material were used for the radiocarbon age, or
- a possibility that the sample was contaminated by marine remains.

A total of 32 dates was removed from the dataset, leaving 108 dates from 51 sites for the analysis (Appendix B). The sites removed were to create a dataset, used as a test, to see how well the data fits the model. Radiocarbon ages used in this dataset include the ages from mixed components and the radiocarbon ages with a standard error greater than 200 years. Dates that were out of stratigraphic order, the dated material was not identified, multiple materials were used to for the radiocarbon analysis, or if there was a possible contamination of the sample, were not used. A total of 15 sites with a total of 27 radiocarbon ages were used as a test sample (Table 7.1).

6.5.3 Building the Model

6.5.3.1 Initial Examination of Dataset

To begin, a visual analysis of the data was conducted. This was done by mapping the sites using their geographic locations. Colors were assigned to these points based on their radiocarbon ages (ex. oldest to youngest). Viewing the data became problematic with multiple radiocarbon ages occurring at the same location because only one date was visible at each site. Therefore, sites were grouped by 250 year time periods and mapped. This allowed for the examination of sites relative to location and time.

6.5.3.2 Representing the Data

The dataset includes the following files:

- McKean_sites – Locations of McKean sites with associated radiocarbon dates, faunal remains, floral remains, grinding implements, projectile point types
- Na_dem – A digital elevation model of North America 30 arc seconds (ESRI 2008)
- Admin_boundaries – State and Provincial boundaries 1:10M (ESRI 2008)
- Waterbodies – Waterbodies 1:10M (ESRI 2008)
- Ecoregions – Geographical ecoregions 1:10M (CEC 1997)

A surface (model) was created using the default ordinary Kriging parameters with the McKean site locations and associated radiocarbon ages. The data was then explored. To preserve distance on the map the Canadian Lambert Conical Conform projection was used.

Once the model was created an analysis of the database was conducted. First, a visual examination of how well the model represents the radiocarbon ages of the McKean sites was

conducted. A validation/prediction surface was created to visually examine the strengths and weaknesses in the model. Next, an estimation of errors was conducted of the model using the test dataset. This calculated the predicted values at the McKean sites that were not used in the creation of the surface to see how well the surface fits with the test data. It also provides a standard error value at each location (level of uncertainty). These data were used to verify the model against the exclusion data used as a validation sample.

6.5.3.3 Exploration of Data

A histogram was used to examine the data to see if it is normally distributed and identify other general patterns in the data. Next, a QQ plot was used as a second measure to compare the data to a standard normal distribution. A QQ plot is a graph in which the quantiles from two distributions are plotted versus each other. For two identical distributions the plot will be a straight line. The closer the plotted points are to the straight line in the graph, the closer the data follows a normal distribution. Trends in the data were then examined. A semivariogram was used to measure the spatial autocorrelations between measured points. "The difference squared between the values of each pair of locations is plotted on the y-axis relative to the distance separating each pair of measurements, which is plotted on the x-axis (ESRI 2014)". In a semivarigram plot, the locations that are closest (on the far left of the x-axis) should have small semivariogram values (low values on the y-axis). As the distance between the pairs of locations increases (moving right on the x-axis), the semivariogram values should also increase (move up on the y-axis) (ESRI 2014).

The error values of the model were then examined to see how well the model fit the data. Elements examined included:

- the mean prediction error with a value close to zero
- the root-mean-square standardized prediction error is close to 1, demonstrating the standard errors are accurate
- a small root-mean-square error and average standard error indicating the predictions do not deviate much from the measured values
- if the original examination of the dataset appeared to fit or not fit the model

A test was then conducted to see how well existing data fits within the model. Strong and weak areas within the model were identified. Once the model was finalized an analysis of migration and origins of the McKean Complex in relation to the model was conducted.

6.6 Querying the Database

In Chapter 5, patterns were examined based on site descriptions to gain a general understanding of the McKean Complex. To better understand some specific patterns the following was examined: the location of sites with flora remains, sites with grinding stones and/or manos, the number of faunal species present, and projectile point types in relation to site location.

To examine the relationship of sites and faunal remains an analysis using size classes was conducted. Specific faunal remains in McKean components were described in Chapter 5. Sites were selected for this analysis if faunal remains were recorded. Faunal remains from each McKean component were placed into one of nine groups: SC6-SC1 (Table 7.3 describes each size class), and birds, fish, or bivalves. The numbers of species present were counted for each category at each site. Birds, fish, and bivalves were counted as present or not present and given a value of one if present and zero if not present, regardless of the number of species. Then the total numbers of species were plotted in a map. The total number of species in each site was examined by Ecoregion.

Sites that contained McKean components with floral remains were also examined. Table 4.1 in Chapter 4 provided a summary of these data. Uses of these plants will also be examined in Chapter 7. Grinding slabs and manos are associated with plant processing in McKean sites and the site locations of this data were also examined.

The relationship between the projectile points associated with the McKean Complex is widely debated. This analysis will examine the four projectile point types associated with the McKean Complex: McKean Lanceolate, Duncan, Hanna, and Mallory. The geographic distribution of these points will be examined in relation to the radiocarbon age of the component in which they were found.

Chapter 7: Results and Archaeological Interpretation of Results

7.1 Kriging Analysis

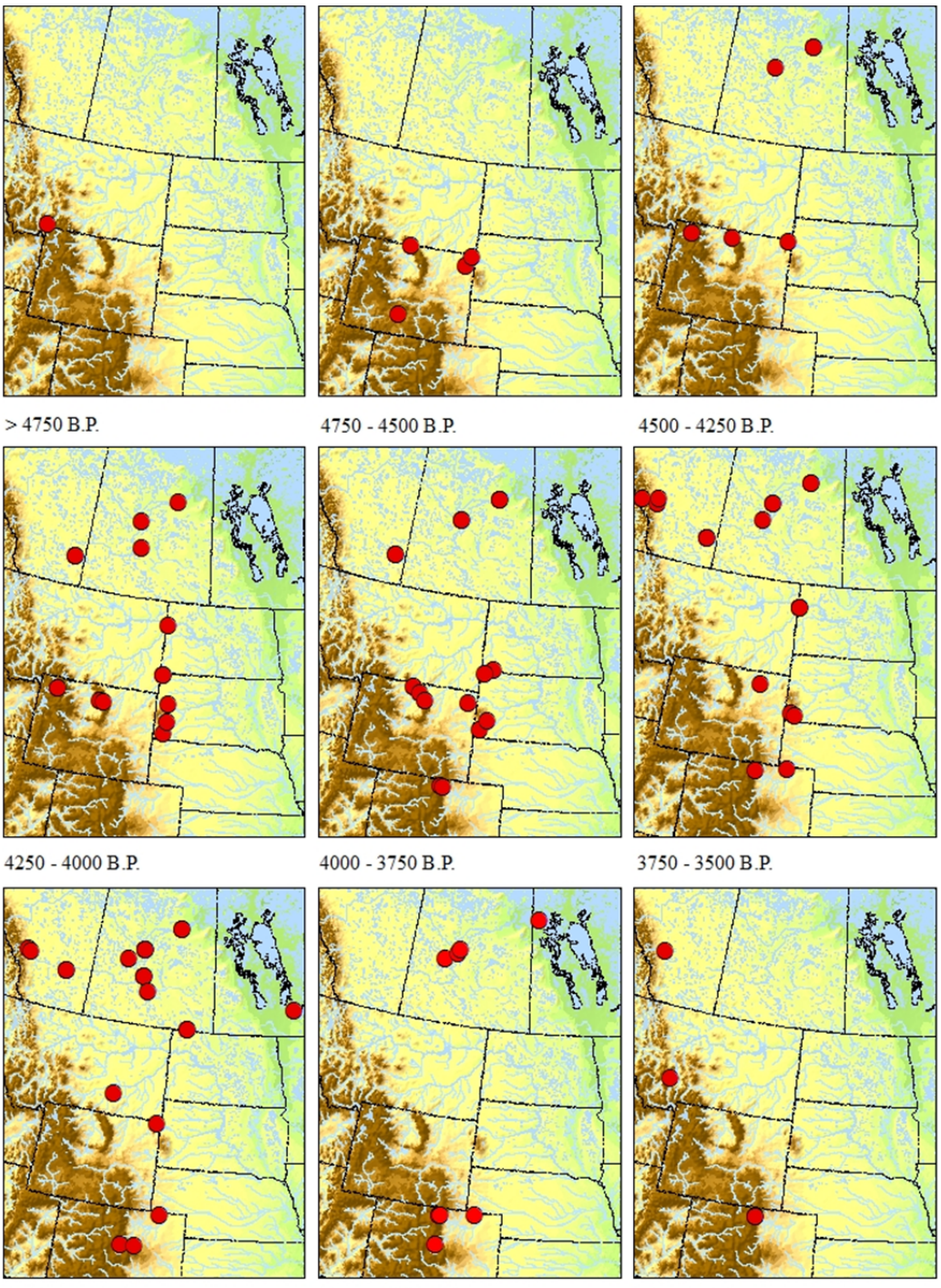
7.1.1 Examination of the Dataset

An initial examination of the dataset provided insight into patterns in the dataset that were readily apparent upon visual inspection. Patterns found in this initial examination allowed for a comparison of how well the model created using Kriging fits the dataset. Overall, the sites used in this analysis are located in a north-south orientation from central Saskatchewan south to Colorado. In the east-west orientation, in Canada, sites are located from Lake Winnipeg to the Rockies in the west. In the United States sites are located from the Missouri River to the Rockies.

To examine the dataset, sites were divided into 250 year groups based on their radiocarbon ages. This grouping allowed for sufficient resolution to examine where the McKean Complex was present on the Northern Plains during specific time periods. As shown in Figure 7.1.1, the sites with the oldest radiocarbon ages are located around the Big Horn Basin and in the Black Hills. By 4500-4250 B.P. the sites are still clustered around those same mountainous regions, but we see that McKean sites are present in what is now central Saskatchewan. These sites in Saskatchewan are located along the South Saskatchewan and the Saskatchewan Rivers.

Between 4250 and 3250 B.P. the highest number of sites associated with McKean components are present on the Northern Plains. Sites continue in the mountainous regions of the Absaroka Range and the Bighorn Mountains until approximately 3750 B.P. Between 4000 and 3500 B.P. we also see the introduction of McKean sites into the Front Range in Colorado. Sites appear to be spreading in a north-south direction.

After 3250 B.P. the numbers of sites begin to diminish. Sites become almost absent from Wyoming after 3500 B.P., though sites can still be found in the Black Hills and the Colorado Front Range at this time. Between 3500 to 3250 B.P. there appear to be more sites located in Saskatchewan and Alberta with the introduction of sites in Manitoba. Between 3000 and 2500 B.P. sites are few in number and located along the Rocky Mountains.

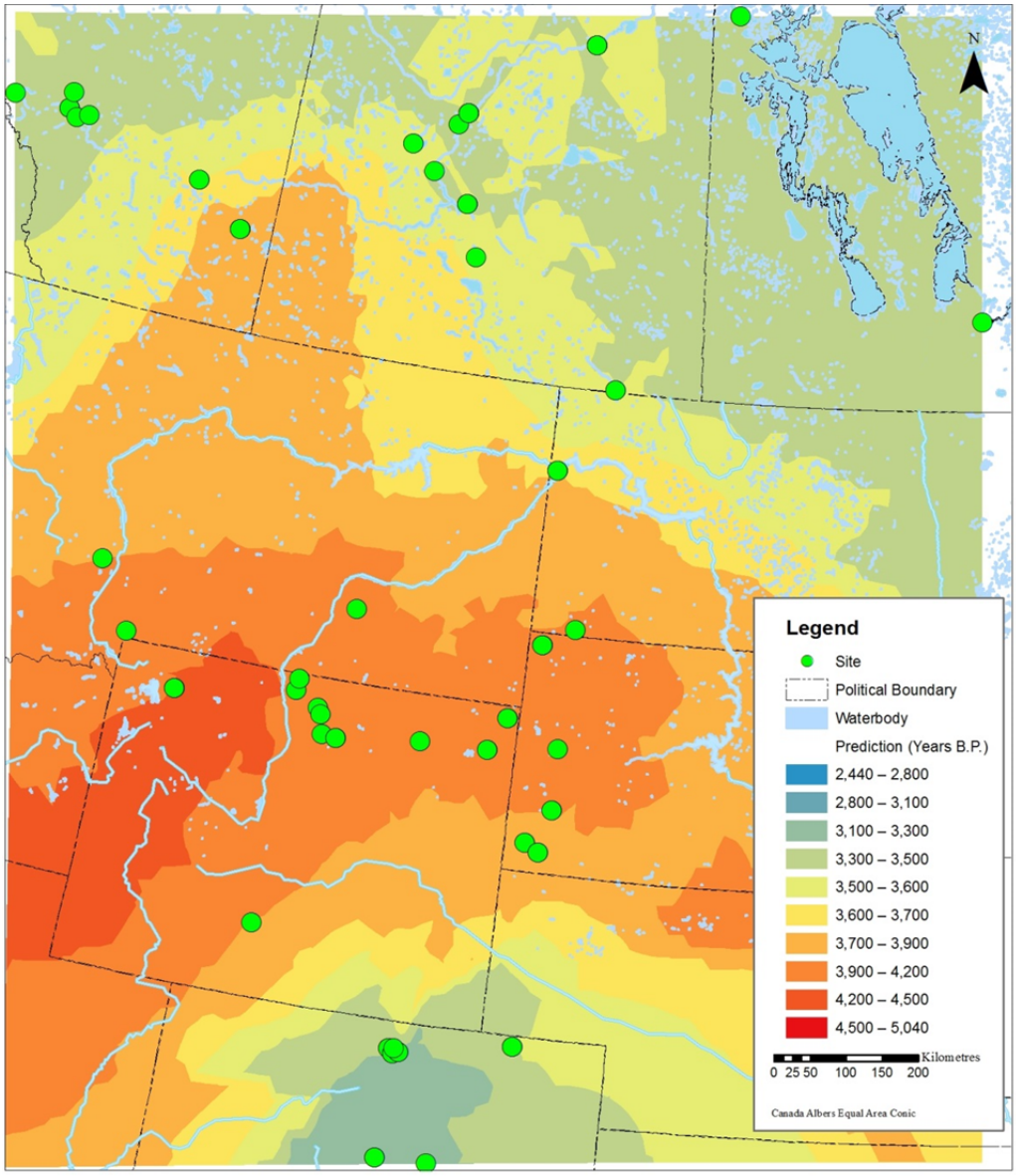


(Arthur 1966; Boen 2013; Brumley 1975; Butchner 1979; Cahill 2012; Calder 1977; CEC 2011; Davis 1976; Davis et al. 2014; Dyck 1983; Dyck and Morlan 1995; ESRI 2008; Fedje 1986; Finnigan et al 1983; Floodman et al. 1997; Forbis 1985; Frary 2009; Fredlund 1979; Frey 1997; Frison 1991; Frison and Huseas 1968; Gilmore et al. 1999; Hanna and Head 2000; Haug 1975; Head et al. 2003; Hjermstad 1998; Husted 1962; Husted and Edgar 2002; Johnson 1975; Keyser and Davis 1984, 1985, and 1999; Kornfeld 1995; Kornfeld and Frison 1985; Lahren 1976; Lobdell 1974; Mack 2000; MacNeish 1958; Malasiuk 2007; Morlan n.d.; Munson 1992; Pletz 2010; Quigg 1986; Ramsay 1993; Reeves 1972; Reher et al. 1985; Rennie and Hughes 1998; Ruebelmann 1982; Steege and Paulley 1964; Stine et al. 2001; Stuart 1990; Syms 1969; Tamplin 1977; Toom 1983; Wettlaufer and Meyerr-Oakes 1960; Wheeler 1995a; 1995b; 1995c; Wilson 1983; Wilson 1984)

Figure 7.1 Sites with McKean Components - 250 Year Increments

7.1.2 The Prediction Model

The Kriging model was created using the ordinary Kriging method. This method assumes that the constant mean is unknown (ESRI 2012). This model takes into account all of the dates at each site. Figure 7.2 shows the results.



(Arthur 1966; Boen 2013; Brumley 1975; Butchner 1979; Cahill 2012; Calder 1977; CEC 2011; Davis 1976; Davis et al. 2014; Dyck 1983; Dyck and Morlan 1995; ESRI 2008; Fedje 1986; Finnigan et al 1983; Floodman et al. 1997; Forbis 1985; Frary 2009; Fredlund 1979; Frey 1997; Frison 1991; Frison and Huseas 1968; Gilmore et al. 1999; Hanna and Head 2000; Haug 1975; Head et al. 2003; Hjermstad 1998; Husted 1962; Husted and Edgar 2002; Johnson 1975; Keyser and Davis 1984, 1985, and 1999; Kornfeld 1995; Kornfeld and Frison 1985; Lahren 1976; Lobdell 1974; Mack 2000; MacNeish 1958; Malasiuk 2007; Morlan n.d.; Munson 1992; Pletz 2010; Quigg 1986; Ramsay 1993; Reeves 1972; Reher et al. 1985; Rennie and Hughes 1998; Ruebelmann 1982; Steege and Paulley 1964; Stine et al. 2001; Stuart 1990; Syms 1969; Tamplin 1977; Toom 1983; Wettlaufer and Meyerr-Oakes 1960; Wheeler 1995a; 1995b; 1995c; Wilson 1983; Wilson 1984)

Figure 7.2 Prediction Model

The model shows the predicted age of sites in unsampled locations. The model predicts that the oldest sites are located around the Bighorn Basin and other early sites would be found in the Black Hills and the areas surrounding the Bighorn Basin. Sites generally get younger as the site location gets further away from the origin area. It appears that there is a spread northward and eastward from the origin location. There is a band of predicted sites (4140 – 3820 B.P.) extending almost all the way from the area of origin to the Crown site, which produced relatively old dates as did sites at Wanuskewin and the Cactus Flower site. The youngest areas are located in Colorado, Alberta, Saskatchewan, and Manitoba. Based on the initial investigation of the dataset this model appears to fit the initial observations.

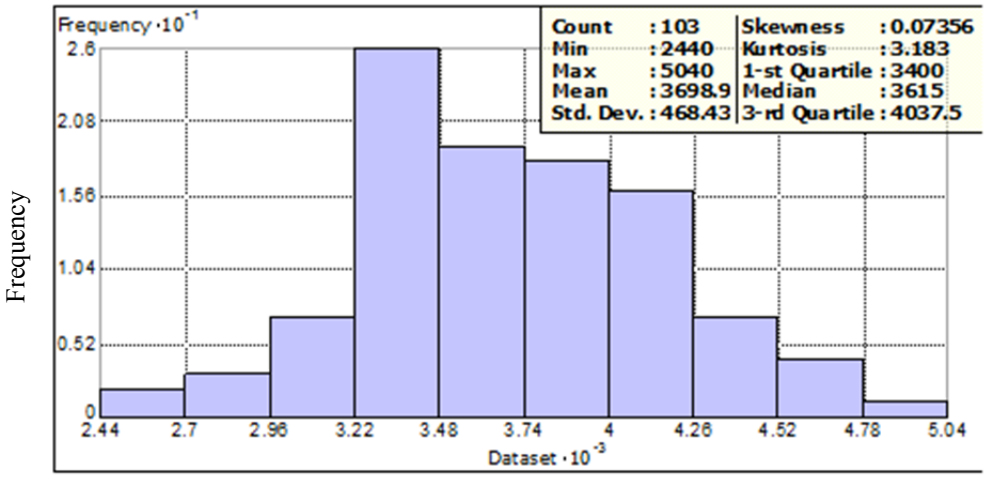


Figure 7.3 Histogram of all McKean Radiocarbon Ages in Dataset

The histogram is divided into 10 classes by quantiles. The data is unimodal and skewed slightly to the right. The mean (3698.9) and median (3615) are relatively close to being the same value demonstrating the data is only slightly skewed. The bar containing values of 3220 – 3480 B.P. represents a relatively large number of values. This represents the time in which the highest number of McKean occupations were present on the plains. The data also shows that there was a sharp decline in the number of radiocarbon ages and sites with McKean components after 3220 B.P.

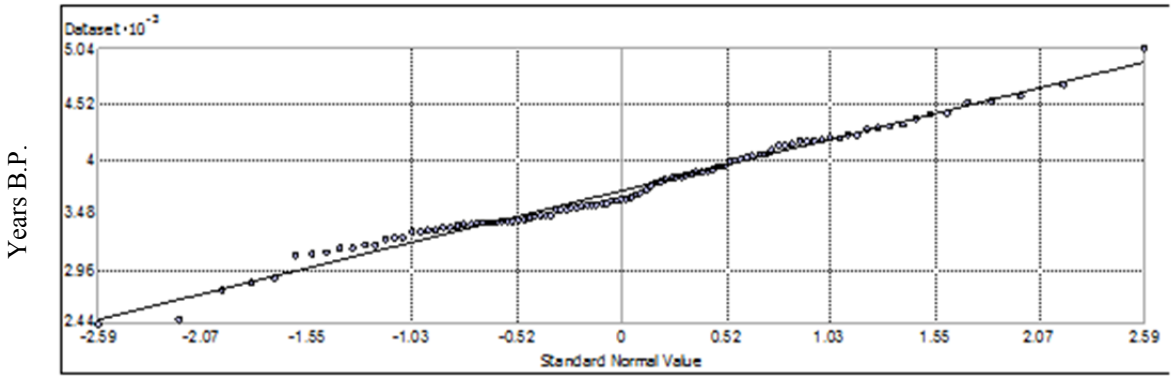


Figure 7.4 Normal QQ Plot

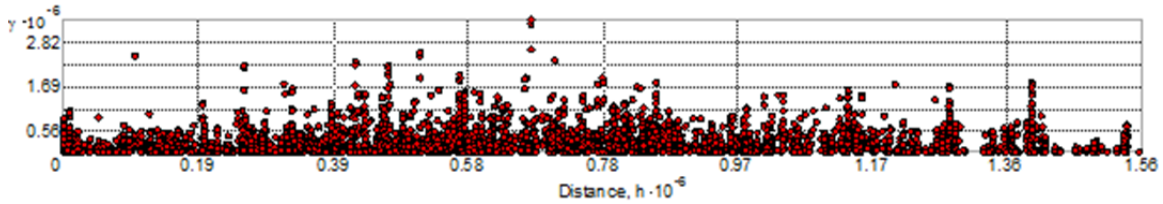


Figure 7.5 Semivariogram of McKean Radiocarbon Ages in Dataset

The normal QQ plot (Quantile-Quantile: Figure 7.4) is a second method to determine how well the dataset fits a normal distribution by how close it fits the theoretical model. If the quantiles and the data distribution agree then the plotted points will coincide with the line or the theoretical model. It is another method of determining how well the data fits a normal distribution. The majority of the data fits the theoretical model.

In the semivariogram (Figure 7.5) it appears that some data locations are closer together (near 0 on the x-axis) and have a higher semivariogram value. On the x-axis is the distance between the locations and on the y-axis the difference of their values squared are plotted. The values that have a higher semivariogram were examined. Many of these points are in a pair corresponding to a large gradient value in the radiocarbon ages. Areas that have high gradients (old dates to younger dates) resulted in higher semivariogram values. The high semivariogram values are unavoidable in this model due to the small sample size.

Lastly, the trend of the dataset was examined. Each vertical stick in Figure 7.6 represents the location and the value of each radiocarbon date. The y-axis represents the north-south direction, and the x-axis represents the east-west direction. A best fit line (polynomial) was fit through the projected points to show trends in each of the two directions. A flat line means there is no trend. In the above analysis we see in the north-south direction (y-axis and green trend line)

that there is a trend. It starts with low values, increases towards the centre, then decreases. In the east-west direction (x-axis and blue trend line) the line is relatively straight. The line is straight from the start, through the centre, and then decreases slightly at the end. This indicates that the data exhibits a trend from the centre of the data in the north-south direction and almost no trend in the east-west direction. This trend is possibly caused by the geographic positions of the sites in relation to their dates, as the dates are more spread out in the north-south direction and more concentrated from east to west. The radiocarbon ages are also generally younger in the peripheries and oldest at the centre of the Study area. A trend analysis was also conducted and the trend in the data was southwest to northeast in orientation.

From the analysis of the model we have learned that the data are unimodal and close to a normal distribution though skewed slightly to the right. The normal QQ plot shows that the data are close to a normal distribution. The data exhibit a trend in the north-south direction and little to no trend in the east-west direction.

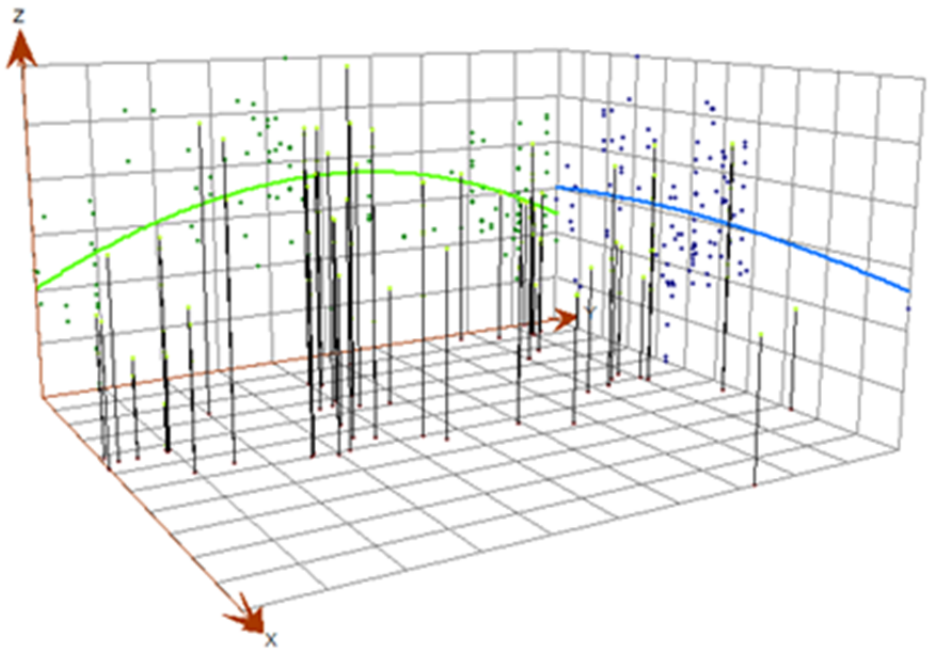


Figure 7.6 Trend Analysis of McKean Radiocarbon Ages in Dataset

In an examination of the error values it was found that the mean standard error was 0.0358 and the root-mean-square standardized prediction error 1.02763. It may appear that the average standard error is quite high (389.8326). Comparing the standard error from the model to

the standard error in Bocquet-Appel et al. (2009) of 444.6 years these values appear acceptable. A possible reason for this high value is that there are multiple dates for a single location giving a high error even for a measured location. The predicted value will only correspond to one of these values and the reset will produce a higher level of error. The root-mean-square value (406.3986) indicates that the predictions do deviate from the measured values. Again, multiple radiocarbon ages for a single site would cause variation of this magnitude.

It is often suggested to keep the model as simple as possible and only remove a trend if there is justification to do so. An example of this justification of removal could be a model of crop production where production changes with latitude due to factors such as temperature, humidity, and rainfall, which change with latitude. There are dangers when using trends, such as overfitting the data, and "leaving too little variation in the residuals to properly account for the uncertainty in prediction" (ESRI 2012). As well, when you remove a trend, there are more parameters to estimate, and the more parameters that are estimated the less precise the model becomes.

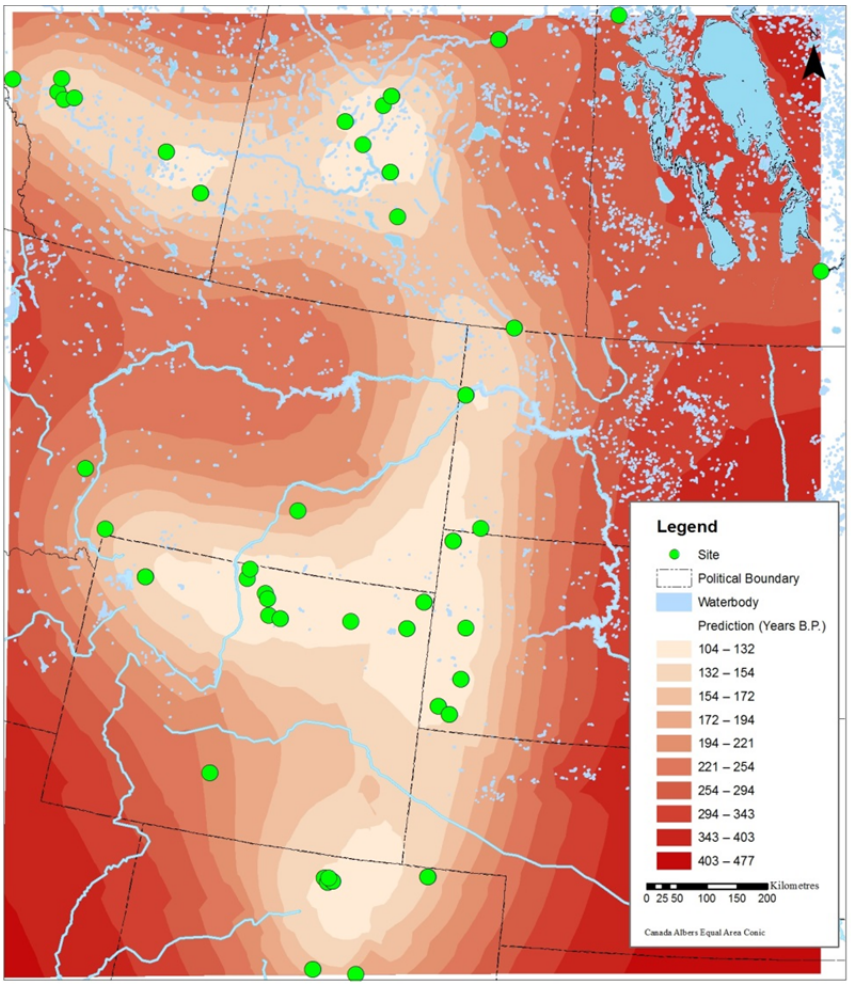
Based on the above information the trend was not removed as there was no justification to do so. It cannot be determined why the sites generally get younger as we move away from the hypothesized origin location. Potential contributing factors could be the environment, population pressure, sampling bias or many other factors that we cannot determine. The purpose of this model is to determine these potential factors, therefore, they are unknown. As well, our dataset is relatively small compared to the geographic area being examined. Therefore, by removing trends and changing more parameters, the surface may become less precise by adding and changing the limited amount of information that is available.

7.1.3 Testing of Model

To test the model a sample was created from the data removed from the original dataset. Radiocarbon ages and sites used in this dataset contain only the radiocarbon ages that were removed due to the mixing of cultural association or that have a standard error greater than 200 years. Table 7.1 displays the results of this test comparing the radiocarbon ages to the predicted age.

Figure 7.7 displays the Prediction Standard Error Map showing where the strengths and weaknesses of the model are. As we can see the strengths of the model are located in areas where

there are more sites and weaknesses lie in areas where there are no sites and along the peripheries of the Study area. Areas in Montana and Manitoba show the greatest amount of error in the Study area. Sites in the test sample that did not work well with this model include Cherry Point, Sorenson, Meyers-Hindman, and Signal Butte. Cherry Point and Signal Butte are located on the peripheries of the Study area and are located in areas that would have greater amounts of error (Figure 7.7). Sorenson and Meyers-Hindman are located in an area between the oldest sites and the area of no sites in Montana. There will likely be higher levels of error in this region due to the absence of sites in Montana used in this analysis.



(Arthur 1966; Boen 2013; Brumley 1975; Butchner 1979; Cahill 2012; Calder 1977; Davis 1976; Davis et al. 2014; Dyck 1983; Dyck and Morlan 1995; ESRI 2008; Fedje 1986; Finnigan et al 1983; Floodman et al. 1997; Forbis 1985; Frary 2009; Fredlund 1979; Frey 1997; Frison 1991; Frison and Huseas 1968; Gilmore et al. 1999; Hanna and Head 2000; Haug 1975; Head et al. 2003; Hjermstad 1998; Husted 1962; Husted and Edgar 2002; Johnson 1975; Keyser and Davis 1984, 1985, and 1999; Kornfeld 1995; Kornfeld and Frison 1985; Lahren 1976; Lobdell 1974; Mack 2000; MacNeish 1958; Malasiuk 2007; Morlan n.d.; Munson 1992; Pletz 2010; Quigg 1986; Ramsay 1993; Reeves 1972; Reher et al. 1985; Rennie and Hughes 1998; Ruebelmann 1982; Steege and Paulley 1964; Stine et al. 2001; Stuart 1990; Syms 1969; Tamplin 1977; Toom 1983; Wettlaufer and Meyerr-Oakes 1960; Wheeler 1995a; 1995b; 1995c; Wilson 1983; Wilson 1984)

Figure 7.7 Prediction Standard Error Map (ESRI 2008)

Table 7.1 Test Sample of Model

Site Name	Site #	Date B.P.	Predicted years B.P.	Error	Standard Error	Standardized Error	Normal Value
Pass Creek Cabin	DgPl-1	3860 +/- 215	3547.24	-312.76	445.09	-0.70	-0.85
	EaPk-201	3720 +/- 260	3497.77	-222.23	415.79	-0.53	-0.51
	EgPn-430	3580 +/- 70	3461.94	-118.06	411.53	-0.29	-0.23
Cherry Point	DkMe-10	2830 +/- 260	3543.39	713.39	460.50	1.55	1.61
Cherry Point	DkMe-10	2860 +/- 210	3543.39	683.39	460.50	1.48	1.35
Dead Indian Creek	48PA55	3800 +/- 110	4174.36	374.36	407.65	0.92	0.73
Dead Indian Creek	48PA55	4180 +/- 250	4174.36	-5.64	407.65	-0.01	0.13
Dead Indian Creek	48PA55	4430 +/- 250	4174.36	-255.64	407.65	-0.63	-0.73
Natrona Housepit site	48NA2526	3820 +/- 50	3964.57	144.57	414.82	0.35	0.62
Natrona Housepit site	48NA2526	3870 +/- 50	3964.57	94.57	414.82	0.23	0.51
Natrona Housepit site	48NA2526	3910 +/- 50	3964.57	54.57	414.82	0.13	0.41
Natrona Housepit site	48NA2526	3920 +/- 50	3964.57	44.57	414.82	0.11	0.23
Natrona Housepit site	48NA2526	4080 +/- 70	3964.57	-115.43	414.82	-0.28	-0.13
Natrona Housepit site	48NA2526	4840 +/- 50	3964.57	-875.43	414.82	-2.11	-1.61
Sorenson	24CB202	4900 +/- 250	4135.86	-764.14	412.82	-1.85	-1.35
Meyers-Hindman	24PA504	3150 +/- 110	4000.39	850.39	421.39	2.02	2.10
Meyers-Hindman	24PA504	3530 +/- 110	4000.39	470.39	421.39	1.12	1.15
Benson's Butte	24BH1726	4230 +/- 50	4037.76	-192.24	411.38	-0.47	-0.41
Swallow site	5JF321	3440 +/- 90	3200.63	-239.37	409.61	-0.58	-0.62
Swallow site	5JF321	3150 +/- 100	3200.63	50.63	409.61	0.12	0.32
Bradford House II	5JF52	3255 +/- 765	3204.89	-50.11	410.41	-0.12	0.04
Falcon's Nest	5JF211	2760 +/- 110	3207.57	447.57	411.48	1.09	0.99
Lightning Spring site	39HN20	3430 +/- 270	3815.67	385.67	405.72	0.95	0.85
Lightning Spring site	39HN20	3870 +/- 210	3815.67	-54.33	405.72	-0.13	-0.04
Gant site	39ME9	4130 +/- 130	4000.89	-129.11	401.68	-0.32	-0.32
Signal Butte	25SF1	4170 +/- 250	3491.86	-678.14	408.61	-1.66	-1.15
Signal Butte	25SF1	4550 +/- 220	3491.86	-1058.14	408.61	-2.59	-2.10

7.1.4 Discussion

In the test sample sites in Alberta produced ages younger than expected. There were no test sites in Saskatchewan. The Manitoba test sample was older than expected. The sites in Wyoming worked well with at least one of the dates from each site being less than +/- 60 years of the actual date. Two of the four sites in Montana produced predicted ages of less than 360 years in error. Sites in Colorado worked well with the model, likely due to the test sites being in close proximity to the sites used to build the model. Sites in South Dakota also worked well with small amounts of error relative to the actual radiocarbon age of the site. The Signal Butte site in Nebraska did not fit the model well. Areas where there were few or no sites used to create the model produced the areas with the highest degree of error. It appears that the model works well in three regions: (1) between the Absaroka Range and the Black Hills, (2) in northern Colorado, and (3) in central Saskatchewan and Alberta. These are areas with the largest concentration of sites that were used to create the model.

7.1.4.1 McKean Origins

This model supports a few different theories with regards to the McKean Complex origins. An examination of the model shows that the oldest McKean components are located around the Bighorn Basin. Other areas where sites are predicted to be of considerable age include areas around the Bighorn Mountains, the Absaroka Range, and the Black Hills. The model suggests that older McKean sites will also be located to the southwest of this area including mountainous and basin areas such as the Bighorn Basin, the Great Divide Basin, the Wind River Range, and the Wyoming Range of the Rocky Mountains. Hilman (personal communication 2014) noted that the Early Middle Archaic sites are present longer in the south of Wyoming than in the north. This suggests that the origin location indicated in the model has a smaller geographic footprint than shown and that the origin would be concentrated in the area in and surrounding the Bighorn Basin. This supports theories of origins in the Rockies (Webster 2004; Morlan 1993).

The Savannah site (24MA1144) is located in the foothills in southwestern Montana and provides some evidence of a McKean precursor site near that area of origin based on early McKean-like projectile points and an early radiocarbon age. A brief description of the site can be

found in Chapter 4, Section 4.2. As well, based solely on site cultural association and geography, it provides a line of evidence that McKean may have developed from Late Paleoindian cultures.

A cultural continuum was noted by Tratebas (1998) by suggesting that there was an *in situ* development of the McKean Complex in the Black Hills region based on petroglyph traditions showing cultural continuity. As well, sites such as Medicine Lodge Creek, Mummy Cave, Southsider Cave, Meyers-Hindman, and the Sorenson Site in the Middle Rockies show a long cultural continuity based on projectile point styles from Paleoindian times. Specifically, McKean sites in this area containing Late Paleoindian projectile points include Bottleneck Cave, Medicine Lodge Creek, Mummy Cave, Southsider Cave, Sorenson, Meyers-Hindman, and Mule Creek Rockshelter.

While the Oxbow Complex is not being examined directly, this model can provide some insight into the theory that the McKean Complex is derived from the Oxbow Complex. It appears that the origin of the McKean Complex occurs in a fairly concentrated area while Oxbow was already present across the Northern Plains. An examination of the published Oxbow sites with associated radiocarbon ages of sites near the area identified as the possible McKean origin included the following sites: the Sun River site in west central Montana (5700 – 3500 B.P.), Mummy Cave (~5000 B.P), and Dead Indian Creek (~4500 B.P.) (Frison 1991:86). In this area other Early Archaic projectile point styles are evident including Bitterroot side-notched projectile points. The geographic distribution of Oxbow is generally described to be found in northern Montana, Alberta, and Saskatchewan (Frison 1991:86). There are sites that contain both Oxbow and McKean diagnostic artifacts including Long Creek, the Crown Site, the Sullivan Site, the Boy Chief site, Majorville Medicine Wheel, Thundercloud, Cut Arm, and EgNo-23. Oxbow is often found below McKean in stratified sites, but mixed components are difficult to explain (Webster 2004). Evidence through differences in burial practices indicated that these are likely two different cultures.

Husted's (1969) hypothesis, supported by the Fourth of July site (Benedict 1981), where McKean developed from progenitors in high mountain Altithermal areas is partially disputed by this model. This model does not dispute that people would have moved into refuge areas during this time, as other research has shown that people did move to areas with more reliable resources (Walker 1992). This model does not examine that time period prior to when the McKean Complex was present on the Northern Plains. This model also does not dispute that McKean

developed from high mountain areas as it appears that the origin of the McKean Complex lies in the mountains surrounding the Bighorn Basin. However, it does dispute the Colorado mountain location. The model shows that sites located in the Colorado area are considerably younger than those at the hypothesized origin location. Therefore, the area surrounding the Fourth of July site as a possible progenitor location does not fit this model.

7.1.4.2 Migration

The spread of the McKean Complex was quite rapid. The demise was also quite sudden as the number of sites rapidly decreased around 3220 B.P. By 2440 B.P. McKean sites were non-existent on the Plains with sites only being located in the foothills and mountainous areas of the Rocky Mountains. The McKean Complex first appears in the mountainous areas surrounding the Bighorn Basin. Many of the oldest dates are concentrated in the areas of the Absaroka Range, the Big Horn Mountains, and the Black Hills, as well as the surrounding vicinity. Sites are located in a wide range of environments as demonstrated in Chapter 5 outlining the McKean sites in various ecoregions.

To provide a simple examination of the rates of spread of the McKean Complex we will examine distances and changes in radiocarbon ages from the hypothesized origin of the McKean Complex. The following table outlines these speeds as the based only on the oldest radiocarbon age of each site and the distance between sites as the crown flies. Speed is described in kilometres per year. These speeds are comparable to the spread of the Neolithic across Europe (0.6 – 1.3 km/year) , the initial colonization of Europe (0.4 km/year) and the spread of Folsom from the Hell Gap Site (1.7 km/year) (Collard et al. 2010; Fort et al. 2004).

Table 7.2 Rate of Movement from Origin Location

Start Location	End Location	Distance (km)	Δ RC age (years)	Speed (km/year)	Direction from Origin
Rigler Bluff	Dipper Gap	795	1520	0.52	SE
Rigler Bluff	McKean	450	528	0.85	E
Rigler Bluff	Crown Site	1045	710	1.47	NNE
Rigler Bluff	Cactus Flower	580	820	0.71	N

There are two processes that archaeologists have identified to explain transition in prehistory, the movement of ideas (cultural diffusion) and the movement of people (demic diffusion). Cultural diffusion is assumed to be faster than demic diffusion because with cultural

diffusion learning can occur across and within a generation of people. But recent studies have shown that demic diffusion can be rapid if the population has niche preferences that limit dispersal such as river valleys (Campos et al. 2006). Distinguishing between these two types of diffusion is difficult using the archaeological record especially if there is evidence of a population that is already in place (Hamilton and Buchanan 2007; Rodrigues-Iturbe et al. 2009). When there is no pre-existing population the process would be demic diffusion (Collard et al. 2010).

Table 7.2 shows a relatively rapid movement northward along the Saskatchewan River region. The McKean Complex was present at the Crown Site before sites such as Cactus Flower, Thundercloud, Cut Arm and Redtail. A McKean occupation did occur at the Dog Child Site before the Crown Site was occupied. This rapid spread northwards is indicated by the speed at which this technology would have travelled. The spread of the McKean complex projectile point technology travelled faster northwards from the origin location than it did to the nearby Black Hills. There appears to be a band of older dates extending from the origin area north to the area surrounding the Crown site. This pathway shows the movement of this technology early into central Saskatchewan.

The speed in which this Complex spread is relatively faster to the north than to the east and the south. This faster rate may demonstrate a cultural diffusion. Peck (2011) suggested that this movement occurred potentially by following a river system and the use of niche ecosystems along a river system and this could be the reason for the quick speed that this Complex reached the Crown Site. The introduction of the McKean Complex in Colorado coincides with the highest number of sites. This movement may be due to population pressures in the Black Hills and the need to move to new areas because of pressures on the resources.

Some researchers (Davis and Keyser 1999; Tratebas 1998) have suggested that the McKean Complex in Canada is best explained by diffusion of points rather than migration due to a lack of grinding stones, differences in faunal assemblages, and lack of slab-lined roasting pits. Grinding stones are evident in Canada at the Redtail site and the Wolf Willow site (Walker 2015, personal communication). The lack of slab-lined roasting pits and fewer grinding stones could possibly be related to the scarcity of slab type rocks in the northern regions of the Northern Plains. Slabs of rocks would be easier to acquire in mountainous environments. In the northern regions, rocks are often till, debris and sediment left behind after the last glaciation. As will be

seen in section 7.2.1, there is no evidence for differences in faunal assemblages from north to south. While the highest average number of faunal species were found in the Middle Rockies, other areas that have higher than average numbers of faunal remains (by species) include the Aspen Parklands and the Mid-Boreal Lowland and Interlake Plain. Some southern areas such as the West-central Semi-arid Prairies and the Temperate Plains contain the fewest numbers on average.

Support for a migratory population is also evident by the Gray Burial site. This is an Oxbow burial site located near Swift Current, Saskatchewan. This burial site contains hundreds of burials in a cemetery associated with the Oxbow Complex. Walker (personal communication, 2012) has suggested that this is a type of territorial marker, marking the territory of an existing population to a migratory population. Currently, this is the only known cemetery style burial ground on the Northern Plains. The model presented in this research provides one line of evidence to support this theory. If in fact there was a migratory population of the McKean Complex onto the Canadian Northern Plains and the route suggested was used, the Gray Burial Site is located within this pathway The position of this burial ground suggests that it is possible that it was a territorial marker positioned used as a sign for a migratory population. If this is the case this marker did not work as the McKean Complex spread quite quickly into and beyond this region. The differences in mortuary behaviour of Oxbow and McKean also suggest that these are two different populations (Walker 1984).

7.2 Spatial Examination of Dataset

7.2.1 Faunal Remains

The faunal remains were categorized and grouped based on size and number of different identifiable species in each size groups. Birds, ducks, geese, and grouse were grouped as a single group and counted as a single group. All fish and all bivalves were also grouped into individual groups with no distinction based on species. Table 7.3 describes the category sizes used as well as the identified fauna for each size class or group. Table 7.4 outlines the number of identifiable species found in each site and corresponding ecoregion.

Table 7.3 Faunal Size Classes

Size Class	Description	Types of Fauna Found in McKean Components
SC6	Very Large Mammal	Bison, Moose, Elk, Bear, Artirodactyl, Very Large Mammal
SC5	Large Mammal	Pronghorn, Deer, Bighorn Sheep, Wapiti,Wolf/Dog/Coyote *, Large Mammal
SC4	Medium Mammal	Beaver, Badger, Porcupine, Bobat, Medium Mammal
SC3	Small-Medium Mammal	Prairie Dog, Fox, Skunk, Rabbit/Hare, Marmot, Muskrat
SC2	Small Mammal/Vertebrate	Ground Squirrel, Rodent, Gopher, Small Mammal
SC1	Micro-Mammal/Vertebrate	Toad, Frog, Reptile
	Birds	Birds, Duck, Geese, Grouse
	Fish	Fish
	Bivalves	Bivalves

* Wolf/Dog/Coyote can be categorized in either SC5 or SC4

Table 7.4 outlines the average number of identifiable species per site in each ecoregion. The total average number of species for each site is 3.3. The highest number of species per ecoregion is the Middle Rockies. Other higher than average locations include the Aspen Parkland and the Mid-Boreal Lowland and Interlake Plain. The lowest numbers of species per ecoregion are the Northern Lakes and Forests and the West-central Semi-arid Prairies. Sites with the highest number of species include Dead Indian Creek (13), Meyers-Hindman (10), the Crown site (8), Hitching Post Ranch (8), the McKean site (7), Southsider Cave (7), and the Redtail site (7).

Figure 7.8 demonstrates the number of species that have been found in McKean components in sites on the Northern Plains. What becomes evident by this map is that there is a wide range of the number of species utilized and that the utilization of multiples species occurs everywhere. Typically, McKean components contain an average of four species though many sites contain more (Table 7.5). Bison remains are found in most of the sites though they are not always the predominate species present. Other common animals include bighorn sheep, deer, and pronghorn. Animal procurement indicates that there is not a focus on bison and that multiple species are often found and the types of species are indicative of the environment that the site is located. As noted by Webster (2004:124), “the utilization of bison and other large artiodactyls is common in McKean sites located throughout the Northern Plains and should no longer be considered a Canadian phenomenon”. This analysis agrees with Webster’s (2004) findings.

Table 7.4 Average Species per Site (McKean Components) by Ecoregion

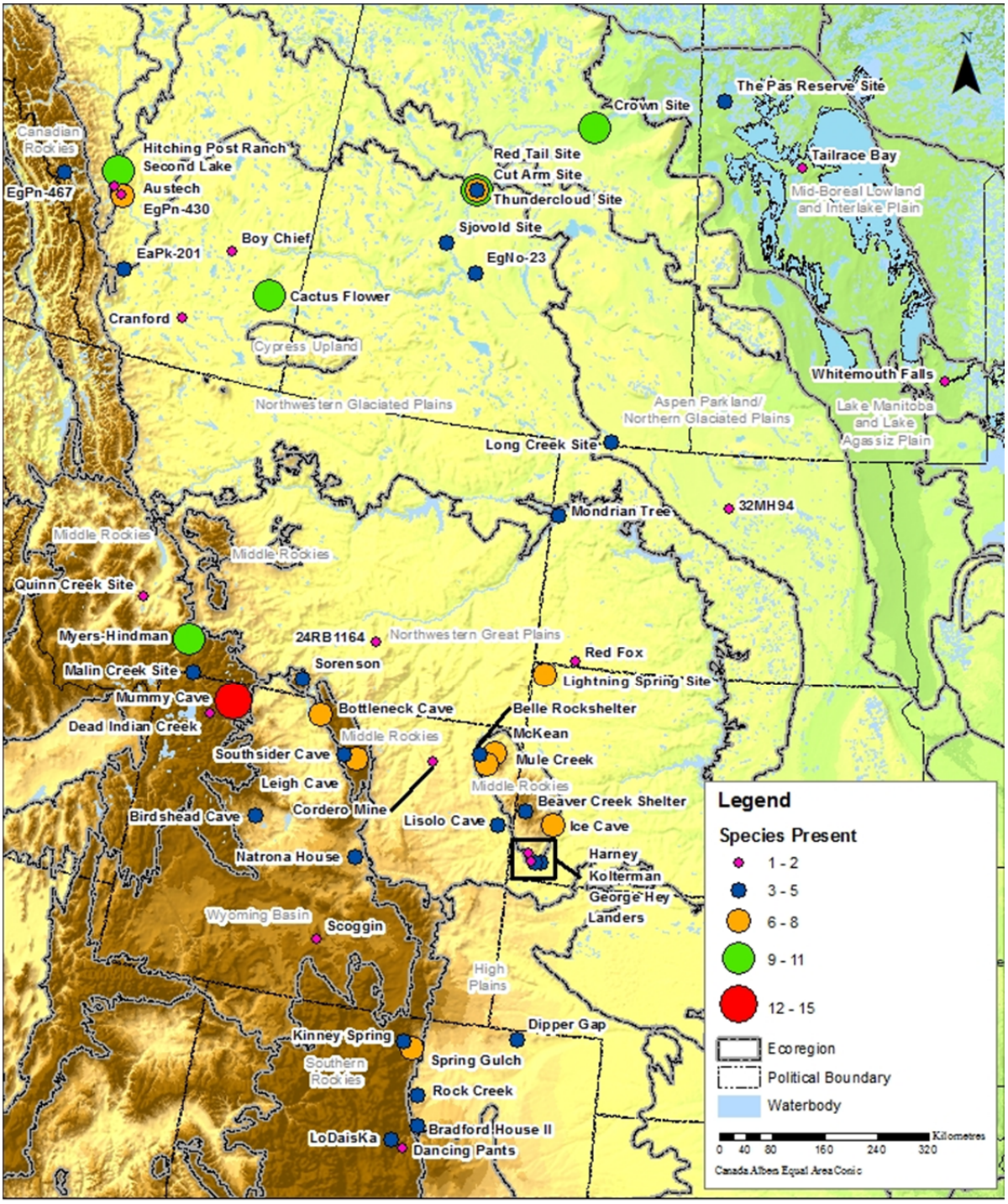
Ecoregion	Average # Species Per Site
Aspen Parkland	4.2
High Plain	3.5
Canadian Rockies	3.0
Mid-Boreal Lowland and Interlake Plain	5.3
Middle Rockies	5.8
Northern Lakes and Forests	1.0
Northwestern Glaciated Plains	3.8
Northwestern Great Plain	2.3
Southern Rockies	3.0
Temperate Plains	2.0
West-central Semi-arid Prairies	2.5
Wyoming Basin	3.7
Total Average	**3.3**

Table 7.5 Faunal remains associated with McKean Components

Site	Borden	Ecodistrict	Size Class Present						Total # of Species	Other Present		
			SC6	SC5	SC4	SC3	SC2	SC1		Birds	Fish	Bivalves
EgPn-430	EgNp-430	Aspen Parkland/Northern	1	2	0	2	0	0	**5**	-	-	y
EgPn-467	EgPn-467	Aspen Parkland/Northern	1	0	0	0	0	0	**1**	-	-	-
Hitching Post Ranch	EiPo-51	Aspen Parkland/Northern	2	3	0	1	2	0	**8**	y	-	-
Austech	EhPo-55	Aspen Parkland/Northern	1	0	0	0	0	0	**1**	-	-	-
EaPk-201	EaPk-201	Aspen Parkland/Northern	1	2	0	0	0	0	**3**	y	-	-
Long Creek	DgMr-1	Aspen Parkland/Northern	1	1	0	1	1	0	**4**	-	-	-
Second Lake	EhPv-58	Canadian Rockies	1	1	1	0	0	0	**3**	-	-	-
Dipper Gap	5LO101	High Plain	1	2	0	0	0	0	**3**	-	-	-
Rock Creek Site	5BL2712	High Plain	0	0	1	1	1	0	**3**	y	-	-
Pas Reserve	FkMh-5	Mid-Boreal Lowland and Interlake Plain	1	1	0	0	0	0	**2**	-	y	-
Tailrace Bay	GRS-1	Mid-Boreal Lowland and Interlake Plain	0	0	0	0	0	0	**0**	y	y	-
Crown Site	FhNa-86	Mid-Boreal Uplands and Peace-Wabaska	3	2	1	2	0	0	**8**	y	y	y
Belle Rockshelter	48CK4	Middle Rockies	1	2	0	0	0	0	**3**	-	-	y
McKean Site	48CK7	Middle Rockies	1	3	0	1	1	1	**7**	y	-	-
Bottleneck Cave	48BH206	Middle Rockies	0	4	0	1	1	0	**6**	-	y	-
Dead Indian Creek	48PA551	Middle Rockies	3	4	1	2	3	0	**13**	y	-	y
Leigh Cave	48WA304	Middle Rockies	0	2	0	0	2	0	**4**	-	-	-
Mummy Cave	48PA201	Middle Rockies	0	1	0	0	0	0	**1**	-	-	-
Southsider Cave	48BH364	Middle Rockies	2	2	1	2	0	0	**7**	-	-	-
Mule Creek Rockshelter	48CK204	Middle Rockies	1	3	1	0	0	0	**5**	y	-	y
Quinn Creek	4JF110	Middle Rockies	0	1	0	0	1	0	**2**	-	-	-
Malin Creek	24YE353	Middle Rockies	2	1	0	0	0	0	**3**	-	-	-
Sorenson	24CB202	Middle Rockies	1	2	0	0	0	0	**3**	-	-	-
Meyers-Hindman	24PA504	Middle Rockies	3	4	2	1	0	0	**10**	-	-	-
Ice Cave	39PN326	Middle Rockies	2	1	0	1	0	0	**4**	-	-	-
Beaver Creek Shelter	39CU779	Middle Rockies	1	3	0	1	0	1	**6**	-	-	-
Whitemouth Falls	EaLa-1	Northern Lakes and Forests	1	0	0	0	0	0	**1**	-	-	-
Cranford site	DlPb-2	Northwestern Glaciated Plains	1	0	0	0	0	0	**1**	-	-	-
Cactus Flower	EbOp-16	Northwestern Glaciated Plains	1	3	0	2	0	0	**6**	y	y	y
Boy Chief	EeOv-68	Northwestern Glaciated Plains	1	0	0	0	0	0	**1**	-	-	-
Sjovold site	EiNs-4	Northwestern Glaciated Plains	1	2	0	0	0	0	**3**	-	-	-
Redtail	FbNp-10	Northwestern Glaciated Plains	1	2	0	1	1	2	**7**	y	y	y
Thundercloud	FbNp-25	Northwestern Glaciated Plains	1	1	1	2	1	0	**6**	y	-	-

Table 7.5 (continued) Faunal remains associated with McKean Components

Site	Borden	Ecodistrict	Size Class Present						Total # of Species	Other Present		
			SC6	SC5	SC4	SC3	SC2	SC1		Birds	Fish	Bivalves
Cut Arm	FbNp-22	Northwestern Glaciated Plains	2	1	0	0	1	0	**4**	-	-	-
Meewasin	FbNp-22	Northwestern Glaciated Plains	2	0	0	0	0	0	**2**	-	-	-
EgNo-23	EgNo-23	Northwestern Glaciated Plains	1	1	0	0	1	0	**3**	-	-	-
Sullivan site	EjNr-1	Northwestern Glaciated Plains	1	0	0	0	0	0	**1**	-	-	-
Camp Rayner	EgNr-2	Northwestern Glaciated Plains	1	1	0	0	1	0	**3**	-	-	-
George Hey	39FA302	Northwestern Glaciated Plains	0	1	0	0	0	0	**1**	-	-	-
Lightning Spring	39HN204	Northwestern Glaciated Plains	1	4	0	0	1	0	**6**	-	-	-
Kolterman	39FA68	Northwestern Glaciated Plains	1	1	0	1	1	0	**4**	-	-	-
Harney Site	39FA10	Northwestern Glaciated Plains	1	0	0	1	0	0	**2**	-	-	y
Landers	39FA54	Northwestern Glaciated Plains	1	2	0	0	0	0	**3**	-	-	-
Lissolo Cave	48WE301	Northwestern Great Plain	2	1	0	0	0	0	**3**	-	-	-
Cordero Site	48CA75	Northwestern Great Plain	1	1	0	0	0	0	**2**	-	-	-
	24RB1164	Northwestern Great Plain	1	1	0	0	0	0	**2**	-	-	-
Kinney Spring	5LR144	Southern Rockies	2	0	0	0	0	0	**2**	-	-	y
LoDaiska Site	5JF142	Southern Rockies	1	1	0	0	1	0	**3**	-	-	-
Dancing Pants	5DA29	Southern Rockies	0	1	0	0	0	0	**1**	-	-	-
Spring Gulch	5LR252	Southern Rockies	1	1	1	1	1	1	**6**	y	-	-
Falcons Nest	5JF211	Southern Rockies	0	1	0	0	0	0	**1**	-	-	-
Bradford House II	5JF51	Southern Rockies	1	1	0	1	0	0	**3**	-	-	-
	32MH94	Temperate Plains	1	1	0	0	0	0	**2**	-	-	-
Red Fox	32BO213	West-central Semi-arid Prairies	1	0	0	0	0	0	**1**	-	-	-
Mondrian Tree	32MZ58	West-central Semi-arid Prairies	2	1	0	1	0	0	**4**	-	-	-
Birdshead Cave	48FR54	Wyoming Basin	0	3	0	1	0	0	**4**	y	-	-
Scoggin Site	48R304	Wyoming Basin	1	0	0	0	0	0	**1**	-	-	-
Natrona Housepit	48NA2526	Wyoming Basin	0	1	0	2	2	0	**5**	-	-	-



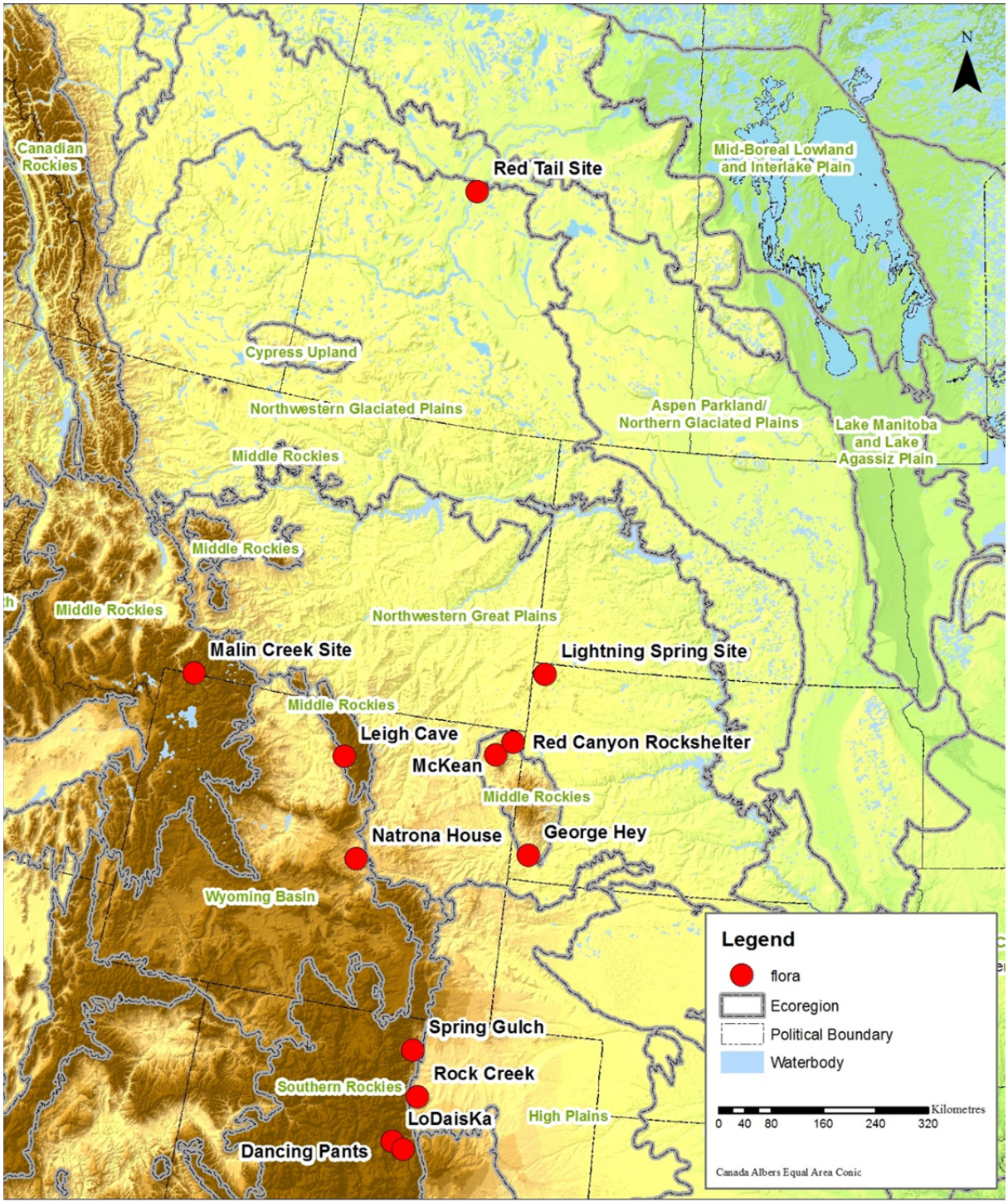
(Brumley 1975; Buchner 1979; CEC 2011; Davis et al. 2012; Dyck and Morlan 1995; ESRI 2008; Fedje 1986; Forbis 1985; Frison 1991; Frison and Huseas 1968; Gilmore et al. 1999; Hanna and Head 2000; Head et al. 2003; Hjermstad 1998; Husted 1962; Husted and Edgar 2002; Keyser and Davis 1985; Lahren 1976; Lobdell 1973; McClelland and Martin 1999; Mulloy 1954; Munson 1992; Quigg 1986; Ramsay 1993; Reher et al. 1985; Rennie and Hughes 1998; Ruebelmann 1982; Simpson et al. 1984; Steege and Paulley 1964; Stine et al. 2001; Stuart 1990; Syms 1969; Tamplin 1977; Toom and Gregg 1983; Tratebas 1998; Van Dyke 1993; Vivian et al. 2005; Webster 1999 and 2004; Wheeler 1995a and 1995c; Wilson 1983)

Figure 7.8 Number of Species in McKean Components

7.2.2 Floral Remains

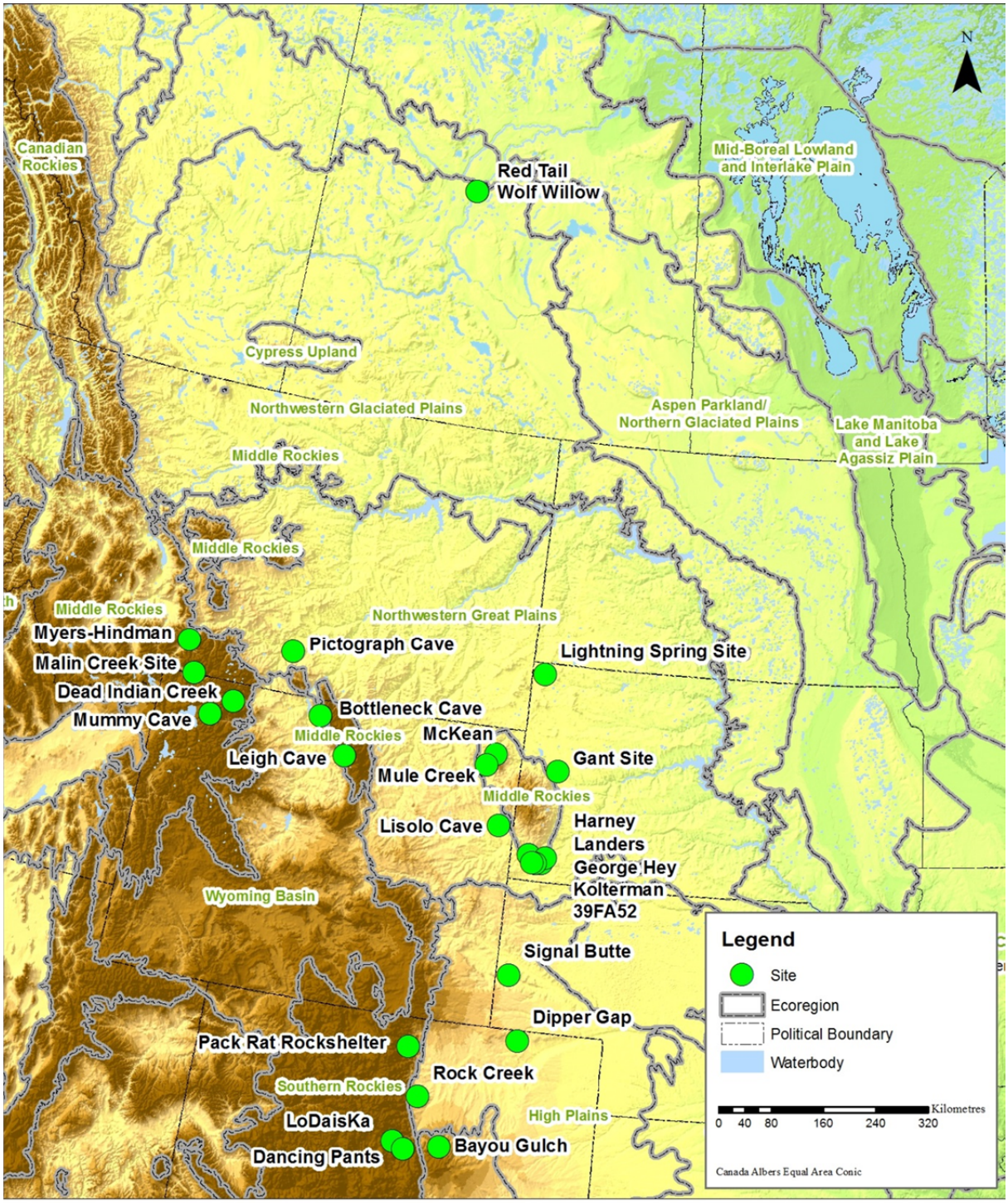
Sites with reported floral remains are generally found in the southern portion of the study area with the exception of the Red Tail site at Wanuskewin Heritage Park located in central Saskatchewan. The most common plant used, which can be found in sites across the entire study region, is goosefoot or pigweed. This plant is common and is found across North America. Nine of the sites identified as having floral remains contained this plant and it is found within sites from Saskatchewan to Colorado. Many parts of the plant can be eaten including the leaves, roots, stalks, and seeds.

Food plants include salt bush, cocklebur, bulrush, acorns, cinquefoil, herbs, compositae, berries, prickly pear, smart weed, grass, sunflower, goosefoot/pigweed, beans, wild onion, wild rose and pine nuts. Medicinal plants include berries, wild rose, smartweed, prickly pear, mallow, bulrush, and cocklebur. Table 7.6 outlines some of the possible uses for the plants used by the McKean Complex.



(CEC 2011; Davis et al. 2012; ESRI 2008; Gilmore et al. 1999; Keyser and Davis 1999; Kornfeld 1995; McClelland and Martin 1999; Ramsay 1993; Tratebas 1998)

Figure 7.9 McKean Sites with Plant Remains



(CEC 2011; Davis et al. 2012; ESRI 2008; Forbis 1985; Frison and Huseas 1968; Gilmore et al. 1999; Husted 1962; Keyser and Davis 1999; Kornfeld 1995; Lahren 1976; Ramsay 1993; Ruebelmann 1982; Steege and Paully 1964; Wedel et al. 1968; Wheeler 1995a and 1995b; Wilson 1984)

Figure 7.10 McKean Sites with Grinding Implements

It may appear that plant food utilization is generally restricted to the southern portion of the study area (with the exception of Redtail), but this does not necessarily mean that plants were not utilized at more sites. The absence of evidence for plant utilization does not mean that it does not exist. Many of the recovery methods used in these sites did not include methods for searching for floral remains. As well, many plant remains would not preserve well over time and therefore we would not see them in the archaeological record.

In the absence of plant remains, grinding implements suggest the use of plants. Sites with grinding implements are generally located in the southern region of the study area. Many of the McKean components in this area contain implements such as manos, metates and grinding slabs, though grinding stones were also found at Wolf Willow and the Redtail sites at Wanuskewin (Walker 2015 personal communication). With the current evidence it appears that hunting various game was common throughout the region while the utilization of plant materials was more prevalent in the south, though not exclusive to the south.

Table 7.6 Floral Remains – Possible Uses

Genus/ Species	**Common Name**	**Some Possible Uses**	**Sites**
Allium sp.	Wild Onion	• Used as food raw, cooked, or dried. • Medicinal uses include cough and cold remedies, used for headaches, poultice can be made for swellings, eyewashes, constipation, and a respitory aid. • Stalks can be woven into mat • Can also be used as a dye	• Leigh Cave
Amalanchier alnifolia	Service berry, saskatoon	• Berries can be eaten fresh, dried, used in pemmican, mixed with fat and dried into cakes. Leaves can be used to make tea. • Noted as a starvation food in some cultures • Medicinal uses include use as a dietary aid, infusion of leaves for general healing, a cold remedy, for fevers, or a gynecological aid	• McKean
Atriplex sp.	Salt bush	• Some species fruits eaten for food, leaves can be boiled and eaten, seeds eaten, young leaves boiled and eaten, used as salt • Medicinal uses include use as a stimulant, to treat spider bites, a dermatological aid, a cold remedy • Some species poisonous • Some species leaves can be used as soap, used as a dye	• George Hey

Genus/ Species	Common Name	Some Possible Uses	Sites
Chenopodium sp./ *Amaranthus* sp.	Goosefoot/ pigweed	*Chenopodium* sp. • Seeds eaten raw, cooked, ground or popped. • Leaves used as greens • Medicinal uses include chopping up plant finely and rubbed on skin to keep bugs from biting • Can be used as a dye. *Amaranthus* sp. • Seeds eaten, ground, leaves boiled • Noted as an important food source in some cultures	• George Hey • Lightning Spring • McKean • Redtail • Natrona Housepit • Red Canyon Rockshelter • LoDaiska, Spring Gulch • Rock Creek
cf. Compositae	Compositae	• Roots, tubers, greens, flowers, and seeds (as seasoning) can be used as food	• Redtail • Dancing Pants
Compositae sp.	Domestic sunflower?	• Seeds can be shelled and toasted and eaten whole or ground into a flour.	• Lightning Spring
Cyperaceae sp.	Bulrush, flatsedge	• Use as food includes seeds ground and eaten as mush, tubers can be eaten raw, dried, and ground. • Medicinal uses include use as a cold remedy, a snakebite remedy, and a dermatological aid • Stem fibers can be used as cordage and woven	• Rock Creek
	Dicotyledon		• Dancing Pants
Fabaceae sp.	Bean	• Eaten cooked, later can be served cold	• Lightning Spring
Fageceae sp.	Acorns	• Food	• LoDaiska
Graminae sp.	Grass	• Food	• George Hey • Lightning Spring • Malin Creek • Dancing Pants
cf. Labiatae	Mint family	• Roots and tubers can be used as food	• Redtail
Malvaceae sp.	Mallow	• Some species can be used food. Leaves can be cooked and eaten, seeds can be eaten fresh. • Noted as a starvation food in some cultures • Medicinal uses include use as a dermatological aid, a gastrointestinal aid, a pediatric aid, and an antirheumatic aid.	• Dancing Pants
Opuntia polyacantha	Prickly pear	• Food uses include eating fruit fresh, dried, baked, as preserves, made into syrup or ground. Buds and flowers can be eaten. Juice can be used as a drink. • Medicinal uses include as a disinfectant, a poultice for burns, a laxative, a diuretic and a dermatological aid	• McKean • Natrona Housepit • Malin Creek
Pinus sp.	Limber Pine, Ponderosa Pine, or Pine sp.	• Seeds can be roasted and used as food • Pinus ponderosa: Parts used for food include inner bark, seeds, pitch used as gum, and young cones chewed for juice • Pinus ponderosa medicinal uses can include use as a dermatological aid, an antirheumatic, or as a poultice.	• Leigh Cave • Dancing Pants • McKean
Potentilla sp.	Cinquefoil	• Roots and tubers eaten as food	• Redtail

Genus/ Species	Common Name	Some Possible Uses	Sites
Pinus sp.	Limber Pine, Ponderosa Pine, or Pine sp.	• Seeds can be roasted and used as food • Pinus ponderosa: Parts used for food include inner bark, seeds, pitch used as gum, and young cones chewed for juice • Pinus ponderosa medicinal uses can include use as a dermatological aid, an antirheumatic, or as a poultice.	• Leigh Cave • Dancing Pants • McKean
Potentilla sp.	Cinquefoil	• Roots and tubers eaten as food	• Redtail
Prunus sp.	Chokecherry	• Berries eaten raw or dried, mixed in Pemmican, dried into cakes • Medicinal uses include everything from anxiety to colds	• Redtail, • Leigh Cave
Sherperdia argentea	Buffalo Berry	• Berries eaten raw, dried and as preserves. • Medicinal uses include use as a gastrointestinal aid and as a laxative	• Leigh Cave
Symphoriapos sp.	snow berry	• Some species of berries can be eaten raw or cooked. Toxic if eaten in large quantities. • Suggested that they are a famine food. • Medicinal uses include dermatological aids, use as a diuretic, a poultice for burns, as eye medicine, antidiarrheal,or a gastrointestinal aid.	• Redtail
Symphoriapos sp.	snowberry	• Some species of berries can be eaten raw or cooked. Toxic if eaten in large quantities. • Suggested that they are a famine food. • Medicinal uses include dermatological aids, use as a diuretic, a poultice for burns, as eye medicine, antidiarrheal,or a gastrointestinal aid.	• Redtail
Rosa sp.	Wild Rose	• Food uses include crushed rose hips in pemmican, fruites eaten fresh, roasted, or dried. Petals can also be eaten. • Noted as a famine food in some cultures • Medicinal uses include use as a gastrointestinal aid, for antidiarrheal purposes, use on sore eyes, and as a throat aid. Stems, roots, inner pulp, and petals used	• Redtail • Leigh Cave
Rumex sp.	Smartweed	• Some species used as food including cooking of green stalks, leaves boiled and eaten as greens • Medicinal uses vary on species of plant uses include as a disinfectant, antidiarrheal, or disinfectant	• Lightning Spring
Xanthium sp.	Cocklebur	• Some species used as food, uses include seeds ground to make a flour. • Medicinal uses include to reduce fever, an antidiarrheal, a venereal aid, a dermatological aid, a laxative, and used on sore eyes • Can be used to make dye	• Rock Creek

(D.E. Moerman 1998, Shay 1980)

7.2.3 Projectile Points

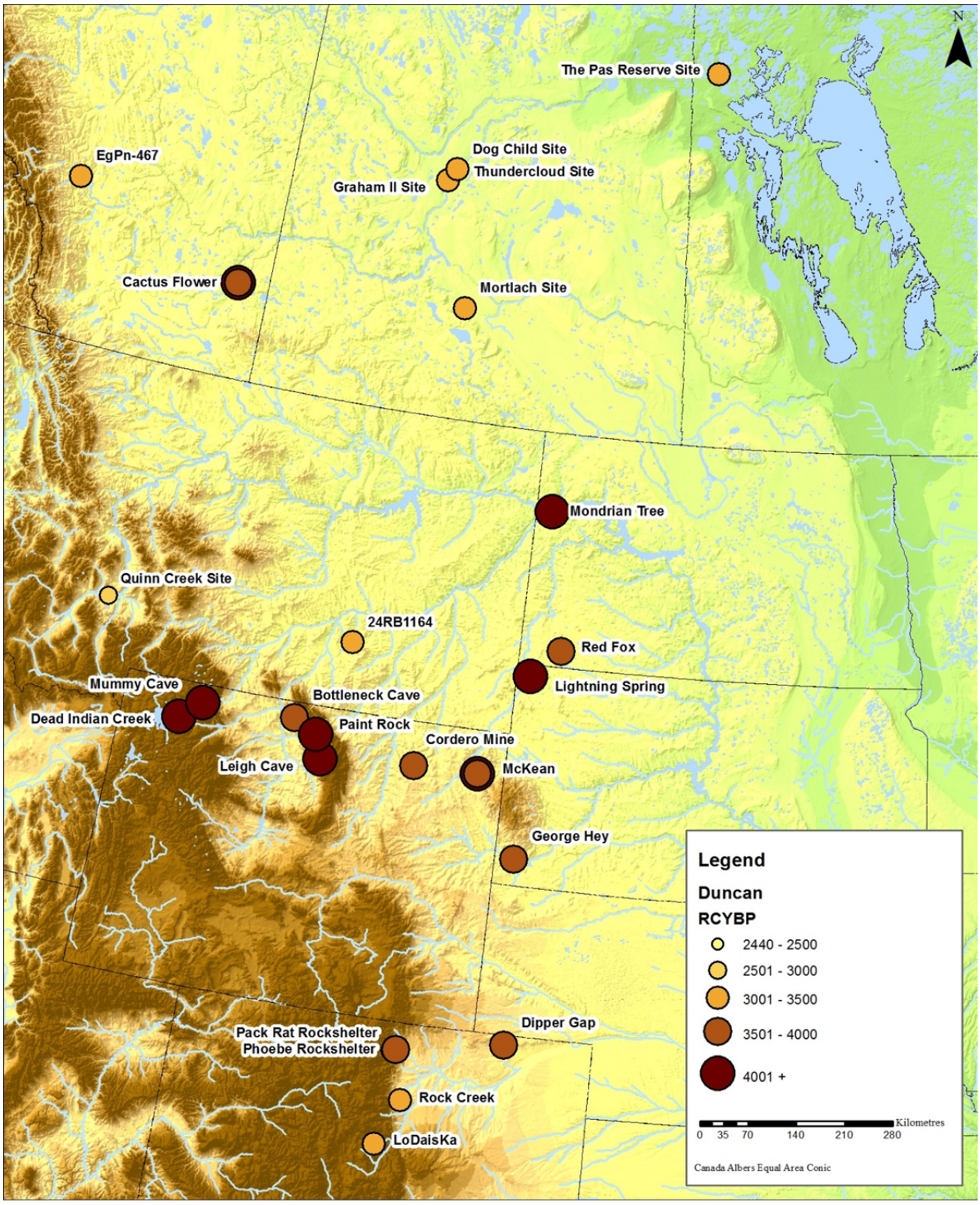
This section examines the projectile points associated with the McKean Complex in relation to space and time. Duncan projectile points are oldest surrounding the Bighorn Basin, in the Black Hills and at the Cactus Flower site in Alberta. In Canada, with the exception of the Cactus Flower site, the radiocarbon ages associated with this projectile point are generally younger than 3620 B.P. Younger sites also appear in Colorado and on the Plains between the Black Hills and the Bighorn Mountains. In Saskatchewan Duncan appears much later than in Alberta.

The oldest radiocarbon ages associated with Hanna projectile points are located in the Black Hills, the Bighorn Mountains, Cactus Flower in Alberta, and in Nebraska. The youngest sites are associated with Hanna projectile points. Hanna points can be found all across the Study area, though it is more prevalent in Canada than the Duncan or Lanceolate forms. In Saskatchewan Hanna appears much later than in Alberta.

The McKean Lanceolate projectile point dates to approximately 4590 B.P. The oldest sites in which it is found are located around the Bighorn Basin, Black Hills, and at the Crown Site. In Canada, dates appear to get younger with the sites associated to the west. Dates associated with this projectile point style are also younger in Colorado along the Front Range.

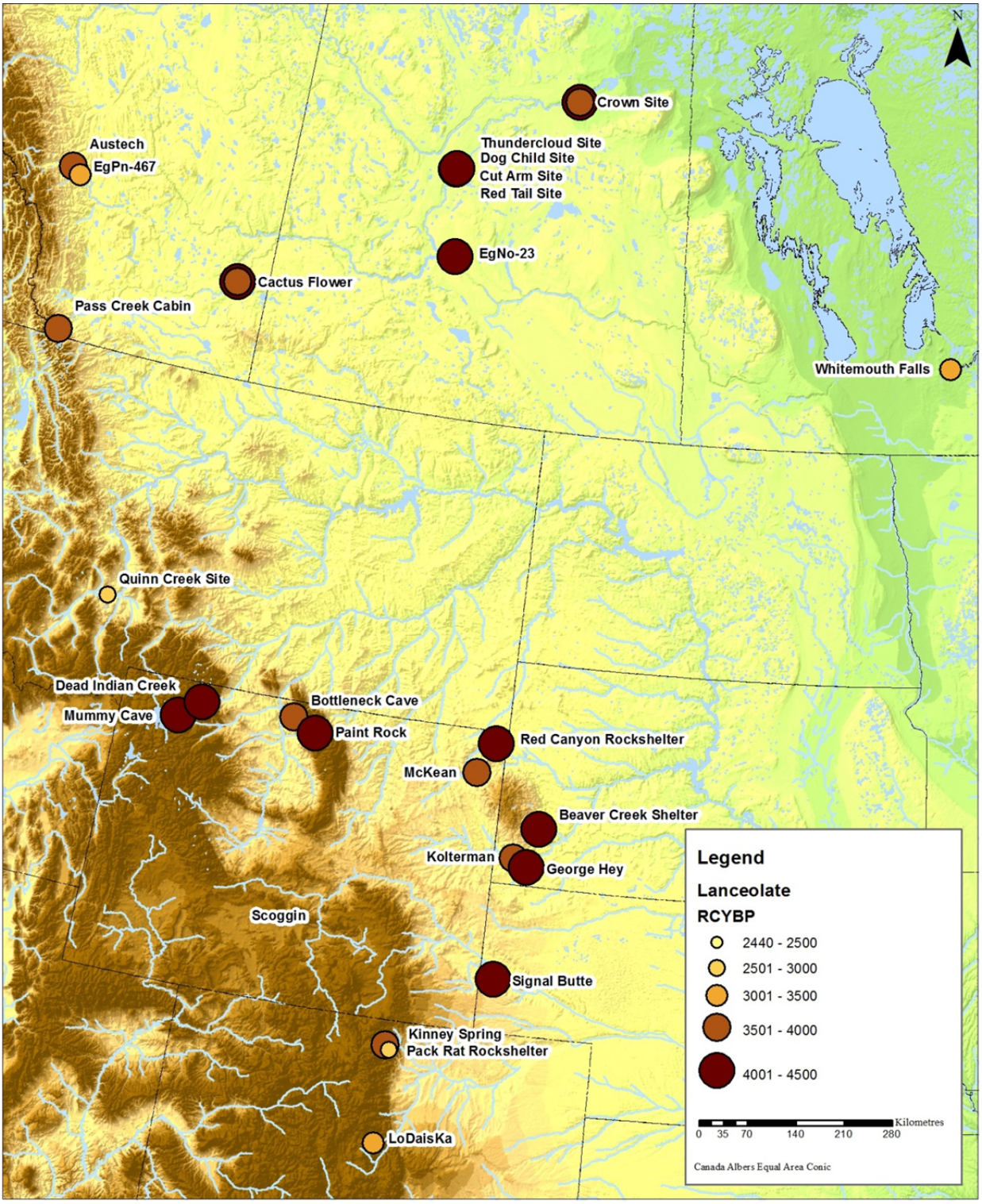
McKean Lanceolate, Duncan, and Hanna are all present in sites across the entire Study area. Many of the oldest dates associated with these projectile point styles are located in the Absaroka Range, Bighorn Mountains, and the Black Hills. Both the oldest and youngest sites are associated with Duncan, Hanna, and McKean Lanceolate projectile points.

Mallory projectile points are found in the southern extent of the Study area. They are located in one of two Ecoregions, the Great Plains or the North American Desert. There are few sites associated with this projectile point style and it has a localized geographic region.



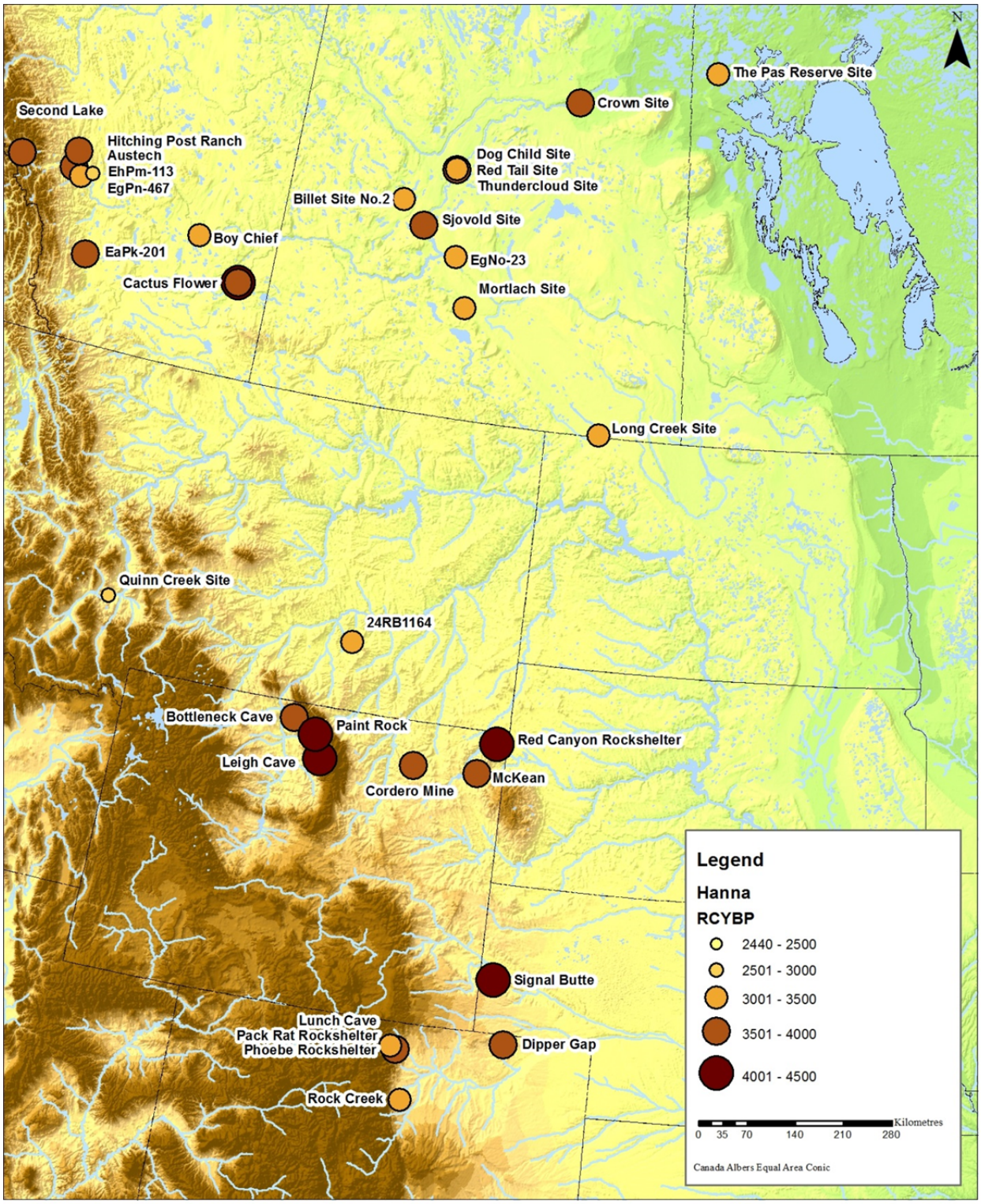
(Brumley 1975; ESRI 2008; Frison 1991; Frison and Huseas 1968; Gilmore et al. 1999; Hanna and Head 2000; Husted 1962; Keyser and Davis 1999; Kornfeld et al. 1995; Toom and Gregg 1983; Munson 1992; Pletz 2010; Reher et al. 1985; Rennie and Hughes 1998; Syms 1969; Tratebas 1998; Walker 1984; Webster 1999; Wedel et al. 1968; Wettlaufer 1956; Wilson 1984)

Figure 7.11 Duncan Projectile Point Geographic Locations and Associated Radiocarbon Ages



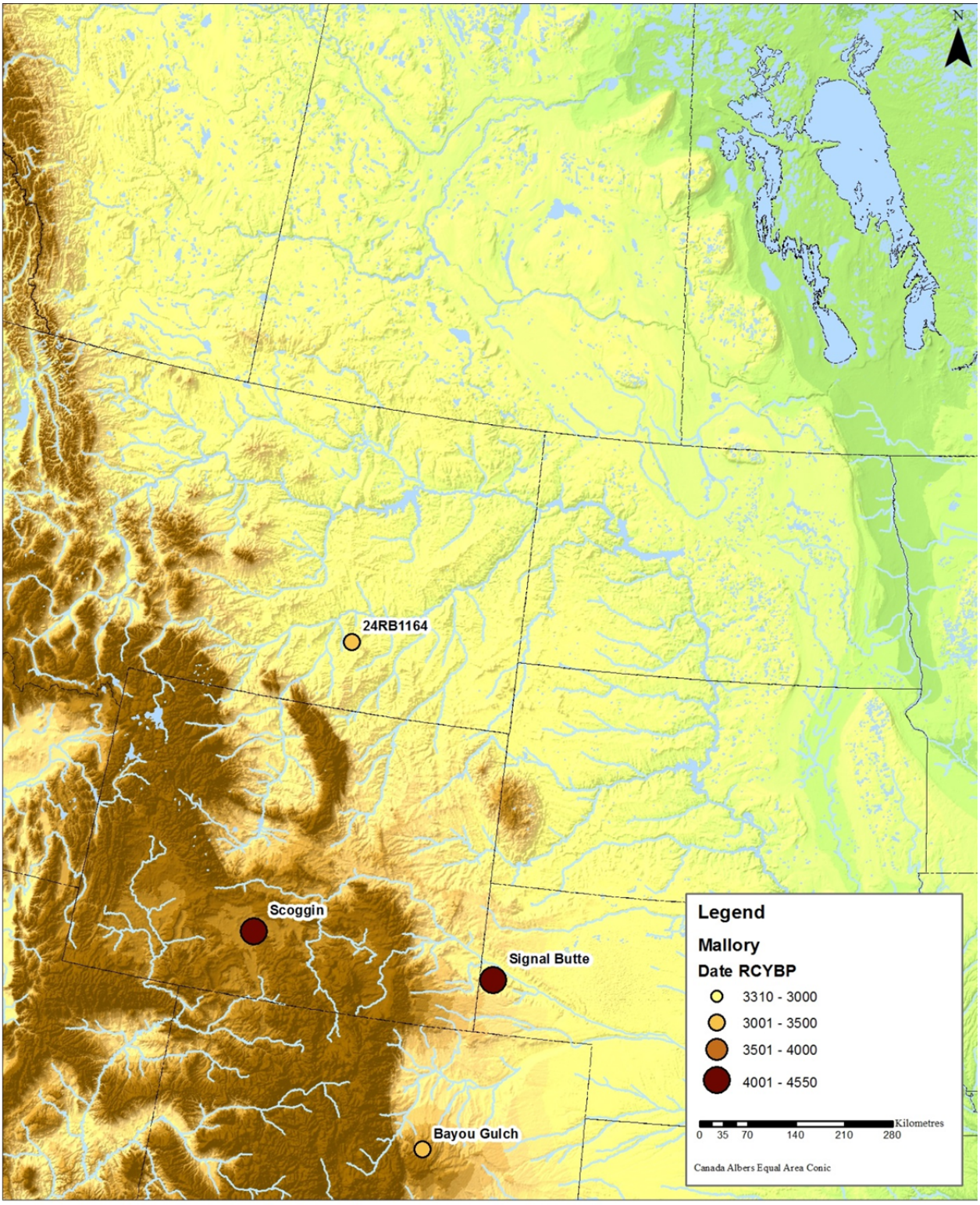
(Buchner 1979; Brumley 1975; ESRI 2008; Forbis 1985; Frison 1991;Hanna and Head 2000; Husted 1962; Gilmore et al. 1999; Kornfeld 1995; Pletz 2010; Quigg 1986; Ramsay 1993; Rennie and Hughes 1998; Tratebas 1998; Van Dyke 1993; Webster 1999 and 2004; Wedel et al. 1968; Wheeler 1995a; Wilson 1984)

Figure 7.12 Lanceolate Projectile Point Geographic Locations and Associated Radiocarbon Ages



(Brumley 1975; Dyck 1983; Dyck and Morlan 1995; ESRI 2008; Fedje 1986; Forbis1985; Frison 1991; Frison and Huseas 1968; Gilmore et al. 1999; Hanna and Head 2000; Head et al. 2003; Husted 1962; Kornfeld 1995; Malasiuk 2007; Meyer-Oakes 1960; Pletz 2010; Quigg 1986; Ramsay 1993; Reher et al. 1985; Tamplin 1977; Tratebas 1998; Van Dyke 1993; Webster 1999 and 2004; Wettlaufer 1956; Wilson 1983)

Figure 7.13 Hanna Projectile Point Geographic Locations and Associated Radiocarbon Ages



(Davis et al. 2012; ESRI 2008; Forbis 1985; Gilmore et al. 1999; Lobdell 1974)

Figure 7.14 Mallory Projectile Point Geographic Locations and Associated Radiocarbon Ages

Chapter 8: Conclusions

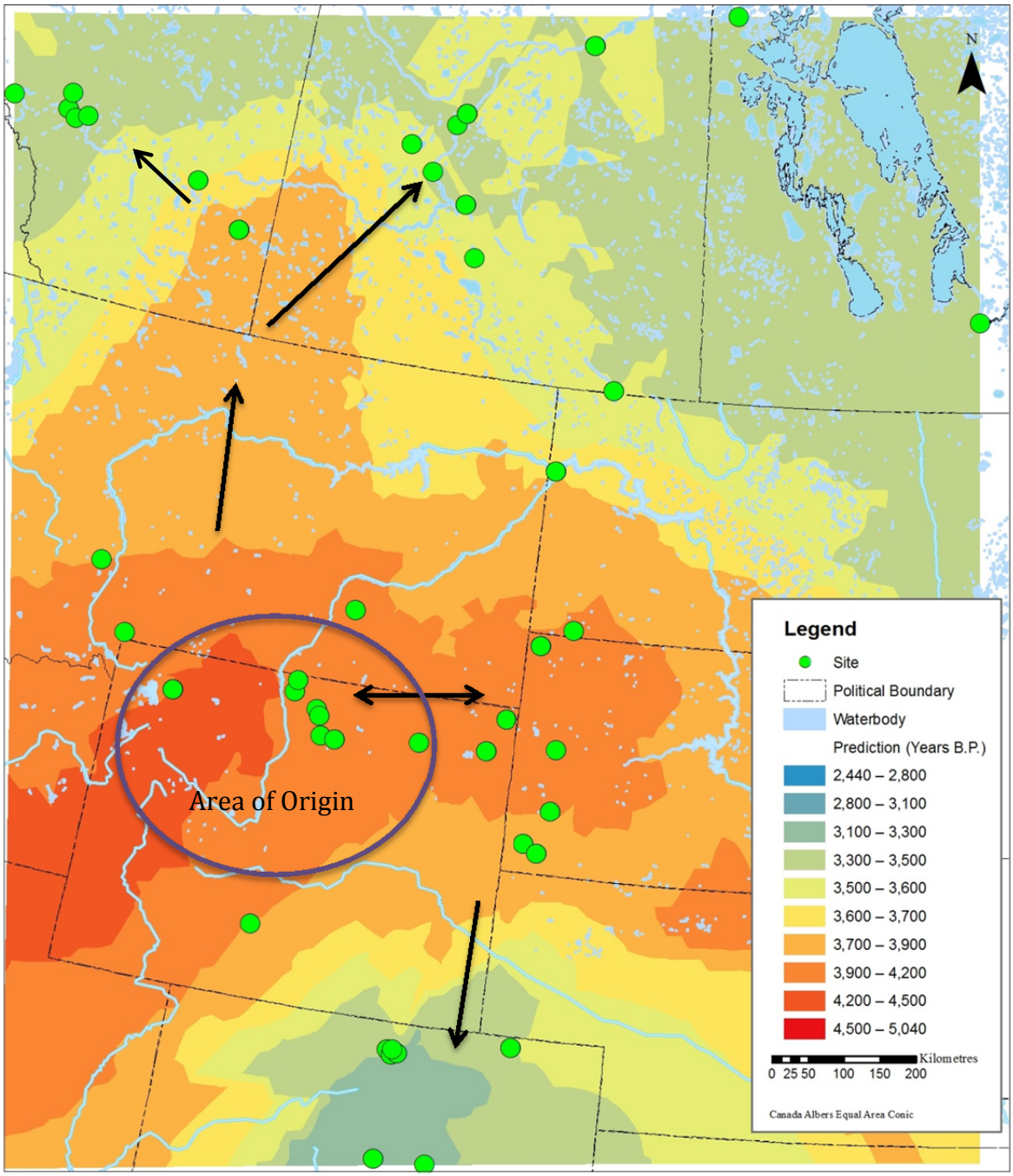
8.1 Summary

The purpose of this research was to gain a better understanding of the McKean Complex through space and time by utilizing site locations and associated radiocarbon ages. The Kriging interpolation has been utilized in archaeological research to understand spread and origins of innovations and people. Following these similar methods, it was hoped that the following questions could be answered:

- Was there a northward movement of the McKean Complex?
- Where does the McKean Complex originate?
- What observations can be made about the McKean Complex with regards to time and space specifically, regarding relationships to environment, taxonomy and subsistence?

Four datasets were created to help better understand the McKean Complex through a spatiotemporal method. The first database was the comprehensive database which contained the sites described in Chapter 5 and is the dataset used to create each subsequent database. This database included information regarding the environment, features, faunal remains, floral remains, type of projectile points, and cultural associations for each site when available. Queries were conducted on this dataset to understand patterns of sites in relation to the environment and each other. The second dataset was comprised of the known McKean components that have associated radiocarbon ages. Two smaller datasets were created from this dataset, the model dataset (used to create the model), the test dataset (used to test the model). The criteria used to create these datasets were examined in Chapter 6. Ordinary Kriging was used to create the model.

The model produced some interesting results. The oldest dates for the McKean Complex are located around the northwestern corner of Wyoming. The predicted oldest ages extend from the northwestern corner of Wyoming extending south-south-west past the southwestern corner of Wyoming. Communications with Hilman (personal communication 2014) noted that the Early Middle Archaic was present longer in the southern parts of Wyoming. This suggests that McKean would have been present later in the southern region, indicating a smaller, localized region of origin in the northwestern part of Wyoming and southwestern Montana.



(Arthur 1966; Boen 2013; Brumley 1975; Butchner 1979; Cahill 2012; Calder 1977; CEC 2011; Davis 1976; Davis et al. 2014; Dyck 1983; Dyck and Morlan 1995; ESRI 2008; Fedje 1986; Finnigan et al 1983; Floodman et al. 1997; Forbis 1985; Frary 2009; Fredlund 1979; Frey 1997; Frison 1991; Frison and Huseas 1968; Gilmore et al. 1999; Hanna and Head 2000; Haug 1975; Head et al. 2003; Hjermstad 1998; Husted 1962; Husted and Edgar 2002; Johnson 1975; Keyser and Davis 1984, 1985, and 1999; Kornfeld 1995; Kornfeld and Frison 1985; Lahren 1976; Lobdell 1974; Mack 2000; MacNeish 1958; Malasiuk 2007; Morlan n.d.; Munson 1992; Pletz 2010; Quigg 1986; Ramsay 1993; Reeves 1972; Reher et al. 1985; Rennie and Hughes 1998; Ruebelmann 1982; Steege and Paulley 1964; Stine et al. 2001; Stuart 1990; Syms 1969; Tamplin 1977; Toom 1983; Wettlaufer and Meyerr-Oakes 1960; Wheeler 1995a; 1995b; 1995c; Wilson 1983; Wilson 1984)

Figure 8.1 Hypothesized Spread of the McKean Complex

From this origin location it appears that there was a spread north, east, and southeast. The general trend in the data is southwest to northeast in orientation. The model predicted that the spread into the Black Hills occurred between 4300-4140 B.P. With sites located from the Absaroka Range to the Black Hills occurring fairly early, and with no current evidence of an intrusive population, this spread of technology was possibly due to an *in situ* development or the spread of a technology to an existing population.

The introduction of the McKean Complex into the north likely occurred by 4300 – 4140 B.P. as indicated by the region surrounding the Crown site. We also see an influx in the number dates around 4140 – 4000 B.P. in Montana and Alberta south of the Cactus Flower site. The major movement of the McKean Complex into the north occurred around 4000 – 3800 B.P. The model indicates that this spread likely occurred from the origin location through Montana, up along the Alberta/ Saskatchewan border, to the area surrounding the Crown site in central Saskatchewan. The predicted ages of the McKean sites in Alberta get younger from the southeast corner towards the mountains in the west. The predicted ages of sites in Manitoba get younger from west to east. If the hypothesized route into Saskatchewan is correct this provides one line of evidence for the Gray site burial being used as a territorial marker, albeit an ineffective one. This model suggests that McKean was an intrusive population to the north based on rapid spread to the north, grinding implements found at Wanuskewin, and the Oxbow Complex being more localized in the north. There is also a hypothesized movement of the Oxbow Complex to the peripheries of the Northern Plains to the boreal forest region around the same time the McKean Complex became present in the Canadian portion of the Northern Plains.

Spread into Colorado occurs quite late and this spread possibly occurred from the Black Hills area, due to a geographical barrier, the Rocky Mountains, located between the area of origin and the sites in Colorado along the Front Range. The timing of this spread into Colorado coincides with the highest number of radiocarbon ages in the sample. This may indicate at this point in time there were population pressures and pressures on the resources that people may have caused people to move into new territories.

Around 3220 B.P. there was a sharp drop off in the number of radiocarbon ages and the number of sites. McKean was present on the Northern Plains from approximately 5000 - 2440 B.P. After 3250 B.P. sites were absent from the within and surrounding the area of origin. By 2440 B.P. the last remaining sites were found along the Rocky Mountains. Pelican Lake was

present on the Northern Plains beginning around 3300 B.P. (Frison 1991), which coincides with the sharp decline in the number of McKean sites starting between 3250 – 3000 B.P.

Sites also tend to be located in forested regions. There are few sites located on the Plains but many are located near mountainous regions, parkland, foothills, and transitional areas between ecoregions. At the end of the McKean Complex period we see a retraction to these regions as the youngest sites are only located along the Rocky Mountains.

Other patterns examined include the number of faunal remains associated with sites, floral remains and features associated with floral processing , as well as the geographic distribution of projectile points. It was found that the average number of faunal species associated with each site (total McKean components) was 3.3 per site indicating that multiple species were utilized. Bison are common throughout the entire region though typically not the predominate species. There are also few bison kill sites associated with the McKean Complex. Other common animals include bighorn sheep, deer, and pronghorn. There is a focus on multiple species across the region. The types of species are indicative of the environment in which the site is found and the utilization of large to small mammals is common throughout the region.

Based on floral remains found and plant processing tools it appears that plant food utilization is more common in the southern region. This does not mean that plants were not used in the northern regions, but rather methods were not used to gather these data or the remains did not preserve. Grinding implements are more common in areas close to or near the mountains. Grinding slabs may be more rare further north due to a lack in slab rocks in this area. Often areas that were glaciated by the last glaciation event are covered in till, unsorted rocks and sediment, likely not suitable for grinding slabs. While slab materials are not absent from these areas they are rarer. This type of material would be more easily found in and near mountainous areas.

The examination of the projectile point styles associated with the McKean Complex was the final part of this analysis. McKean Lanceolate, Duncan, and Hanna are all associated with the area of origin. Duncan points are oldest around the Bighorn Basin, in the Black Hills and at the Cactus Flower site in Alberta. Radiocarbon ages associated with this point style are generally younger than 3620 B.P. In Saskatchewan, Duncan appears much later than in Alberta. Hanna occurs across the entire study area. Hanna appears later in Saskatchewan than in Alberta. The oldest McKean Lanceolate points are found in the area of origin as well as at the Crown Site. Both the oldest and the youngest McKean components are associated with these three projectile

point styles. Mallory points are found in the southern portion of the study area in a localized area. They are located in either the Great Plains or the North American Desert Ecoregion.

This research provides both a comprehensive analysis of the known information about the McKean Complex as well as a preliminary analysis through the creation of a prediction model. Patterns that became apparent included the utilization of multiple species of both fauna and flora. Sites were often located in transitional areas between ecoregions, forested, and foothill areas. These areas provide an abundance of faunal demonstrating a reliance on multiple species. Bison kill sites are uncommon though they do occur. Grinding implements and floral remains are more common in the southern part of the study area though they are present in the north as well. It provides a model from which we can further explore and understand the McKean Complex. It has provided a general understanding of the McKean Complex in relation to the environment and the sites in relation to each other and the radiocarbon ages associated with them. The Kriging method allows one to examine all the dates at one location in relation to the others around it. By interpolating the values between known locations, a preliminary prediction model was created that allows for the examination of possible origins, trends, migrations, and the prediction of site ages in untested locations. With new data this model can be tested further and improved.

8.2 Further Research

While this research project provides insight into existing theories about the McKean Complex, it appears that it has created more questions than answers. What follows are suggestions for further research concerning the McKean Complex on the Northern Plains.

While a comprehensive database of the McKean Complex was created, the comparative dataset is still quite small especially with regards to the number of radiocarbon ages in direct association with diagnostic artifacts. Upon examining the model it becomes apparent that there are regions that produce high levels of error because there are areas of few to no sites. These areas include most of Montana, southwestern Saskatchewan, Manitoba, and central Wyoming. To better understand the McKean Complex, more sites especially with radiocarbon ages, are needed. This will help prove or disprove what this model shows us. Either way it will provide us with more information to better understand the McKean Complex.

Plant subsistence patterns may reflect research questions and practices more so than the actuality of the practices that occured. With the exception of the Red Tail site in Saskatchewan, there are no known McKean components associated with plant remains in the northern part of the study area. As has been previously suggested by Webster (2004), more research on the Northern Plains needs to be done concerning plants and their utilization to provide a more complete picture of subsistence practices.

In the hypothesized pathway that McKean entered into the north there are a couple of areas of interest that may provide insight into the McKean Complex; one is the Cypress Hills. This region is a part of the Middle Rockies Ecodistirct and lies within the area where the initial influx of sites are present in Canada. Being of the same ecoregion as the Black Hills, the Big Horn Mountains, and the Absaroka Range this could potentially be a good place to look for McKean sites. Another interesting site to examine is the Gray site. This is an Oxbow burial site that was possibly used by the Oxbow Complex as a territorial marker. An examination of the relationship between Oxbow and McKean could provide much information regarding the potential interactions between these groups. The overlap and movements of these two groups could provide additional insight into the movement of the McKean Complex. To further understand the terminus of the McKean Complex a study of the relationship between McKean and Pelican Lake could also provide information regarding the relationship between these two groups.

Because the McKean Complex is present in such a large geographic region it becomes difficult to examine trends in the site data because these sites have different purposes and are located in geographically very different regions. The examination of local McKean populations may provide much information regarding the McKean Complex as a whole. For example, there are multiple concentrations of sites in close proximity to one another that could provide insight into local patterns as Davis and Keyser (1999) have done with the Red Fox and the Lightning Spring sites. As it would not be very useful to examine projectile points from two separate areas, a local example would be quite useful. A thesis written about patterns seen in Colorado McKean sites with regards to projectile point analysis has provided much useful information concerning McKean in Colorado (Larmore 2002). With the large number of McKean occupations at Wanuskewin Heritage Park this could potentially provide a good sample of sites to study at a local level.

8.3 Conclusion

This thesis examined the presently known data associated with the McKean Complex. Through this research a prediction model was created to examine these data. While it was able to provide insights regarding origins, migration, and subsistence, there are areas where the model does not work well due to a lack of data. The model will benefit from future research with regards to the McKean Complex. More radiocarbon ages taken from McKean sites can only help improve the current model and help provide a greater understanding of this Complex on the Northern Plains.

Works Cited

Acton, D.F., G.A. Padbury, C.T. Stushnoff
1998 *The Ecoregions of Saskatchewan*. Canadian Plains Research Center, Regina.

Adkins, J.F.
1993 *Falcon's Nest Site (5JF211) Ken Caryl Ranch, Jefferson County, Colorado, Vol. II: Field data, Part 2: Carbon-14 Dates and Rates of Deposition.* MS. On file, Office of Archaeology and Historic Preservation, Colorado Historical Society, Denver.

Alex, L.M.
1991 *The Archaeology of Beaver Creek Shelter (39CU779): A Preliminary Statement*. Division of Cultural Resources, No. 3. National Park Service, Rocky Mountain Region, Denver, Colorado.

Ammerman, A. J. and L. Cavalli-Sforza
1971 Measuring the rate of spread of early farming in Europe. *Man* 6(4):674-688.

1984 *The Neolithic Transition and the Genetics of Populations in Europe.* Princeton University Press, Princeton.

Anderson, T.W., R.W. Mathewes, and C.E. Schweger
1989 Holocene Climatic Trends in Canada with Special Reference to the Hypsithermal Interval. In *Quaternary Geology of Canada and Greenland*, edited by R.J. Fulton, pp. 520-528. Geological Survey of Canada Geology of Canada No. 1. Geological Survey of Canada, Ottawa.

Antevs, E.
1955 Geologic-Climatic Dating in the West. *American Antiquity* 20:317-335.

Anthony, D.
1990 Migration and Archaeology: The Baby and the Bathwater. *American Anthropologist* 92(4):895-914.

Arthur, G.W.
1966 *An Archaeological Survey of the Upper Yellowstone River Drainage, Montana.* Montana State University, Agricultural Economics Research Report No. 26.

Artz, J.A.
1996 Cultural Response or Geological Process? A Comment on Sheehan. *Plains Anthropologist* 41(158):383-393.

Balcom, R.J.
1976 Analysis of the Faunal Remains from the Cherry Point Site in *Papers in Manitoba Archaeology Final Report no. 2.* Department of Tourism, Recreation and Cultural Affairs, Historic Resources Branch, Winnipeg.

Bamforth, D.
2001 High-tech Foragers? Folsom and Later Paleoindian Technology on the Great Plains. *Journal of World Prehistory* 16: 55-98.

Baumler, M. and W. Eckerle
1999 A Tale of Five Cut Banks: Archaeological Excavations and Geoarchaeological Investigations on the Flying D Ranch, Southwestern Montana. *Archaeology in Montana* 40(2):17-31.

Beck, C. and G.T. Jones
2010 Clovis and Western Stemmed: Population Migration and the Meeting of Two Technologies in the Intermountain West. *American Antiquity* 75(1):81-116.

Barnosky, C.W., E.C. Grimm and H.E. Wright Jr.
1987 Towards a Postglacial History of the Northern Great Plains: A Review of the Paleoecological Problems. *Annuals of the Carnegie Museum* 56: 259-273.

Bement, L.
1996 The Cooper Site: A Stratified Folsom Bison Kill in Oklahoma. *Plains Anthropologist* (Memoir 29) 42(159):85-100.

Benedict, J.B.
1981 *The Fourth of July Valley.* Centre for Mountain Archaeology Research Report No. 2, Ward, Colorado.

Benedict, J.B. and B.L. Olson
1973 Origin of the McKean Complex: Evidence from the Timberline. *Plains Anthropologist* 18:323-327.

Black, K.D.
1991 Archaic Continuity in the Colorado Rockies: The Mountain Tradition. *Plains Anthropologist* 36 (133): 1-29.

Bliss, W.L.
1950 Birdshead Cave: A Stratified Site in Wind River Basin, Wyoming. *American Antiquity* 3:187-196.

Boaz J. and Uleberg, E.
2000 Quantifying the non-quantifiable: Studying hunter-gatherer landscapes. In *Beyond the Map: Archaeology Technologies*, edited by G. Lock, pp. 101-115. IOS Press, Amsterdam..

Bocquet-Appel, J.P. and P.Y. Demars
2000 Neanderthal Contraction and Modern Human Colonization of Europe. *Antiquity* 74: 544-552.

Bocquet-Appel, J.P., S. Naji, M. ander Linden, and J.K. Kozlowski
2009 Detection of Diffusion and Contact Zones of Early Farming in Europe from the Space-time Distribution of 14C Dates. *Journal of Archaeological Science,* 36: 807-820.

Boen, R.
2013 *A Class I Cultural Records Survey and Site Evatuations for 39FA21 and 39FA52 for the Trailer Sewer Project, Angostura Reservoir Project #2013.0003L, Fall River County, South Dakota.* Bureau of Reclamation, Rapid City, SD. ARC Archive No: AFA-0490.

Bolstad, P.
2008 *GIS Fundamentals: A First Text on Geographic Information Systems*. 3rd edition. Elder Press, White Bear Lake, Minnesota.

Bove, F.J.
1981 Trend Surface Analysis and the Lowland Classic Maya Collapse. *American Antiquity* 46(1):93-112.

Boyd, M.
2000 Changing Physical and Ecological Landscapes in Southwestern Manitoba in Relation to Folsom (11,000-10,000 BP) and McKean (4,000-3,000 BP) Site Distributions. *Prairie Forum* 25(1):23-44.

Bradley, B.
1993 Paleo-Indian Flaked Stone Technology in the North American High Plains. In *From Kostienki to Clovis: Upper Paleolithic-Paleo-Indian Adaptations,* edited by O. Soffer and N. Praslov, pp 251-262, Plenum Press, New York.

Brink, J.
1988 The Highwood River Site: A Pelican Lake Phase Burial from the Alberta Plains. *Canadian Journal of Archaeology* 12:100-135.

Brumley, J. H.
1975 *The Cactus Flower Site in Southeastern Alberta: 1972-1974 Excavations.* Archaeological Survey of Canada Pper No. 46. National Museum of Man Mercury Series, National Museums of Canada, Ottawa.

Bryant, L.M.
2002 *A Reanalysis of the Long Creek Site: 45 Years After the Excavation.* Unpublished Master's Thesis, Department of Anthropology and Archaeology, University of Saskatchewan, Saskatoon, Saskatchewan.

Buchner, A.P.
1979 The 1978 Caribou Lake Project, Including a Summary of the Prehisotry of East-central Manitoba, *Papers in Manitoba Archaeology Final Report No. 8.* Department of Cultural Affairs and Historical Resources, Historic Resources Branch,Winnipeg.

1980 *Cultural Responses to the Altithermal Climate Along the Eastern Margins of the North American Grasslands: 5,500 to 3,000 B.C.* Mercury Series Paper 97. National Museum of Man, Ottawa.

Butler, W.B.
1981 Eastern Colorado Radiocarbon Dates. *Southwestern Lore* 47(3):12-31.

Cahill, N.
2012 *The Camp Rayner Site (EgNr-2): Archaeological Investigations of a Multi-Component Site in South-central Saskatchewan*. Unpublished Master's Thesis. Department of Anthropology and Archaeology, University of Saskatchewan, Saskatoon, Saskatchewan.

Calder, J.M.
1977 *The Majorville Cairn and Medicine Wheel Site, Alberta.* Mercury Series, Archaeological Survey of Canada Paper 62. National Museum of Man, Ottawa.

Campos, D., J. Fort, and V. Mendez
2006 Transport on Fractal River Networks: Application to Migration Fronts. *Theoretical Population Biology* 69(1):88-93.

Chapman, H.
2009 *Landscape Archaeology and GIS*. The History Press, Stroud.

Chiles, J.P. and P. Delfiner
1999 *Geostatistics: Modeling Spatial Uncertainty*. Wiley, New Jersey.

Collard, M., B. Buchanan, M.J. Hamilton, and M.J. O'Brien
2010 Spatiotemporal dynamics of the Clovis-Folsom Transition . *Journal of Archaeological Science* 37(2010): 2513-2519.

Commission for Environmental Cooperation (CEC)
1997 *Ecological Regions of North America: Towards a Common Perspective.* Commission for Environmental Cooperation, Montreal, Quebec.

Conolly, J. and M. Lake
2010 *Geographical Information Systems in Archaeology.* Cambridge University Press, Cambridge.

Couclelis, H.
1999 Space, time, geography in *Geographical Information Systems: Principles, Techniques, Management and Applications,* edited by Longley, P.A., M.F. Goodchild, D.J. Maguire, and D.W. Rhind. New York, John Wiley and Sons Inc.

Davis, L.B.
1976 The Dodge Site (24RB225): A McKean Phase Lithic "Cache" in the Tongue River Valley. *Archaeology in Montana* 17(1-2):35-51.

Davis C.M. and J.D. Keyser
1999 McKean Complex Projectile Point Typology and Function in the Pine Parklands. *Plains Anthropologist* 44(169):251-270.

Davis, L.B., S.A. Aaberg, P.J. Rennie, J.W. Fisher, Jr., R.J. Ottersberg, and A. Johnson
2012 Geoecology and Precontact Archaeology of the Upper Yellowstone River Valley at Corwin Spring (24PA0195). *Archaeology in Montana* 53(1):1-128.

Deevey, E. S., and R. F. Flint
1957 Postglacial Hypsithermal Interval. *Science* 125: 182-184.

DeMallie, R.J.
2001 Introduction. In *Handbook of North American Indians.* Edited by R. J. DeMallie, pp. 1-13. Volume 13 Part 1 of 2. Smithsonian Institution, Washington.

Donahue, J., J. Abbott, and B. Rhodd
1995 Excavations at the Boulder Creek Rock Shelter. *Newsletter of the South Dakota Archaeological Society* 25(1-2):1-10.

Dyck, I.
1983 The Prehistory of Southern Saskatchewan. In *Tracking Ancient Hunters: Prehistoric Archaeology in Saskatchewan*, edited by H.T. Epp and I. Dyck, pp. 63-139. Saskatchewan Archaeological Society, Regina.

Dyck, I. and R.E. Morlan
1995 *The Sjovold Site: A River Crossing Campsite in the Northern Plains.* Mercury Series, Archaeologial Survey of Canada Paper. Canadian Museum of Civilization, Hull.

Dyke, A S. and V.K Prest
1987 Late Wisconsian and Holocene History of the Laurentide Ice Sheet. *Geographie Physique et Quaternaire* 41(2): 37-263.

Dyke, Arthur, S., D. Giroux, and L. Robertson.
2004 Paleovegetation Maps of Northern North America 18000 to 1000 BP, Geological Survey of Canada, Open File 4682.

Elias, S.A.
2002 Setting the Stage: Environmental Conditions in Beringia as People Entered the New World. In *The First Americans: The Pleistocene Colonization of the New World,* edited by N.B. Joblonski, pp. 9-25. University of California Press, San Francisco.

ESRI
2012 *How Kriging Works.* ArcGIS 10.2.

2014 *ArcGIS Geostatistical Analyst Tutorial*. ArcGIS 10.2.2.

Fedje, D.
1986 Banff Archaeology, 1983-1985 in *Eastern Slopes Prehistory: Selected Papers,* edited by Brian Ronaghan, pp. 25-62. Occasional Paper No. 30. Archaeological Survey of Alberta, Edmonton.

Finnigan, J.T., D. Meyer, and J. Prentice
1983 *Nipawin Reservoir Heritage Study: Resource Inventroy, Assessment and Evaluation,* Volume 5, SRC Publication No. E-903-9-E-83. Saskatcehwan Research Council, Saskatoon.

Floodman, M.G., M. Bergstrom, L. Scott Cummings, and T. Moutoux
1997 *1995-96 Passport in Time: Archeological Investigations at the Boots Site, 32MZ732, McKenzie County, North Dakota.* United States Department of Agriculture.

Forbis, R.
1985 The McKean Complex as Seen from Signal Butte. In *McKean/Middle Plains Archaic: Current Research,* edited by M. Kornfeld and L. Todd, pp. 21-29. Occasional Papers on Wyoming Archaeology No. 4. University of Wyoming, Laramie.

Fort, J., T. Pujol, and L.L. Cavalli-Sforza
2004 Paleolithic population waves of advance. *Cambridge Archaeology Journal* 14:53-61.

Frary, H. E.
2009 *The Meewasin Creek Site (FbN-9): A Re-Examination of the Terminal Middle Precontact Period.* Unpublished Masters Thesis, Department of Archaeology, University of Saskatchewan, Saskatoon.

Fredlund, L.B.
1981 *Inventory and assessment of Cultural resources on Youngs Creek Mine Area*. Mineral Research Center, Butte, MT.

Frey, D.
1997 Lubyk Site. *Saskatchewan Archaeological Society Newsletter* 18(3):56-60.

Frison, G.C.

1962 Wedding of the Waters cave: A stratified site in the Bighorn Basin of Northern Wyoming. *Plains Anthropologist* 7(18):246-265.

1975 Man's Interaction with Holocene Environments on the Plains. *Quaternary Research* 5(2):289-300.

1978 *Prehistoric Hunters of the High Plains.* Academic Press, New York.

1991 *Prehistoric Hunters of the High Plains, 2nd* edition, Academic Press, New York.

Frison , G.C. and M. Huseas

1968 Leigh Cave, Wyoming, Site 48WA304. *The Wyoming Archaeologist* 11:20-33.

Frison, G.C. and D.N. Walker

1984 The Dead Indian Creek Site: An Archaic Occupation in the Absaroka Mountains of Northeastern Wyoming, edited by G.C. Frison and D.N. Walker. *The Wyoming Archaeologist* 27 (1-2):11-122.

Fryxell, R. and R.D. Daugherty

1963 Late Glacial and Post Glacial Geological and Archaeological Chronology of the Columbia Plateau, Washington. *Washington State University Laboratory of Anthropology Report of Investigations* No. 23. Pullman.

Gant, R. and Hurt, Jr., W.R.

1965 The Gant Site, 39ME9. *Museaum News* 26: 19-54.

Gibson, T.H.

1981 Remnant Oxbow on the Northern Plains: The Evidence and It Implications for Regional Prehistory. *Canadian Journal of Archaeology* 5:11-136.

Gill, G.W.

1984 The partial skeleton of a child from Dead Indian Creek. In *The Dead Indian Creek Site: An Archaic Occupation in the Absaroka Mountains of Northewatern Wyoming,* edited by G.C. Frison and D.N. Walker. *The Wyoming Archaeologist* 27(102):97.

Gilmore, K.P., M. Tate, M. Chenault, B. Clark, T. McBride, and M. Wood

1999 *Colorado Prehistory: A Context for the Platte River Basin.* Colorado Council of Professional Archaeologists.

Gkiasta, M., T. Russel, S. Shennan and J. Steele

2003 Neolithic Transition in Europe: The Radiocarbon Record Revisited. A*ntiquity* 77: 45-63.

Gleichman, P.J., and S.C. Phillips
1995 *Excavations at the Rock Creek Site: 1990-1993.* Native Cultural Services, Boulder, Colorado.

Green, J.P.
1975 McKean and Little Lake Technology: A Problem in Projectile Point Typology in the Great Basin of North America. In *Lithic Technology: Making and Using Stone Tools,* edited by E. Swanson, pp. 159-171. Mouton Publishers, The Hague.

Green, D.C.
1998 *A Re-evaluation of the Oxbow Dam Site (DhMn-1): Middle Holocene Cultural Continuity of the Northern Plains.* Unpublished Masters Thesis, Department of Archaeology and Anthropology, University of Saskatchewan, Saskatoon.

Gregg, M.L., P.R. Picha, F.E. Swenson, and A. Bleier
2008 *Archaeological Component of the North Dakota Comprehensive Plan for Historic Preservation.* North Dakota State Preservation Office, North Dakota.

Greiser, T.W. and S.T. Greiser
1988 *Final Report: Cultural Resource Data Recovery Plan Big Sky Mine Area B Rosebud County, Montana.* Prepared for Peabody Coal Company Western Division. Historical Research Associates, Missoula, Montana.

Haberman, T.W.
1986 Comment on McKean Plant Food Utilization. *Plains Anthropologist* 31:237-240.

Haines, A.L.
1966 The Rigler Bluffs Hearth Site: 24PA401. *Archaeology in Montana* 7(2):5.

Hamilton, Marcus J. and Briggs Buchanan
2007 Spatial Gradients in Clovis-age Radiocarbon Dates Across North American Suggesting Rapid Colonization from the North. *Proceedings of the National Academy of Sciences* 104(4):15625-15630.

Hanna, D. and T. Head
2000 Final Report, Historical Resources Impact assessment and Mitigation, Excavations Astley Properties (Pt. W1/2 of 1-25-3-W5M) Permit 97-111.

Harris, T.
2000 Moving GIS: Exploring Movement Within Prehistoric Cultural Landscapes Using GIS. In *Beyond the Map: Archaeology and Spatial Technologies,* edited by G. Lock, pp. 116-123. IOS Press, Washington, DC.

Haspel, H.L. and D.L. Wedel
1985 A Middle Plains Archaic Child Burial from the McKean Site in Northeastern Wyoming. In *McKean/Middle Plains Archaic: Current Research, Occasional Papers on Wyoming Archaeology Number 4*, edited by M. Kornfeld and L.C. Todd, pp. 105-108. Wyoming Recreation Commission, Cheyenne.

Haug, J.K.
1975 The 1974 End-of-Season Field Report on the Cherry Point Site Excavations, Southwestern Manitoba. *Archae-Facts* 2(2- 3):2-20.

Hazelwood, L. and J. Steele
2004 Spatial Dynamics of Human Dispersals Constraints on Modelling and Archaeological Validation. *Journal of Archaeological Science* 31:669-679.

Head, T., L. Gorham, and W. Unfreed
2003 *Saahkomaapina (Boy Chief): EeOv-68*. Occasional Papers of the Archaeological Society of Alberta No. 1. Archaeological Society of Alberta, Calgary.

Hilman, R.
2014 Personal communication.

Hjermstad B.E.
1996 *The Fitzgerald Site: A Besant Pound and Processing Area on the Northern Plains.* Unpublished Masters Thesis, Department of Anthropology and Archaeology, University of Saskatchewan.

1998 *The Pine Coulee Reservoir Historical Resources Impact Mitigation: Final Report, Permit 96-041.* Archaeological Survey of Alberta. Edmonton, Permit No. 1996-041.

Hoppa, R.D., L. Allingham, K. Brownlee, L. Larcombe, and G. Monks
2005 An Analysis of Two Lake Archaic Burials from Manitoba: The Eriksdale Site (EfLl-1), *The Canadian Journal of Archaeology* 29:234-266.

Hughes and J.M. Shippee
1948 *48CK4 Site Form.* Smithsonian Institution River Basin Survey. Copies available from Wyoming SHPO.

Hurt, W.R.
1966 The Altithermal and the Prehistory of the Northern Plains. *Quarternia* 8:101-114.

Husted, W.M.
1962 *A Proposed Archeological Chronology for Rocky Mountain National Park Based on Projectile Pints and Pottery.* A thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts, University of Colorado, Boulder.

1969 *Bighorn Canyon Archaeology.* Smithsonian Institution River Basin Surveys, Publications in Salvage Archaeology No. 12. Lincoln, Nebraska.

1978 Excavation Techniques and cultural layer analysis. In *The Mummy Cave Project in Northwestern Wyoming*, edited by H. McCraken, pp. 50-145. Buffalo Bill Historical Center, Cody, Wyoming.

1995 The Western Macrotradition Twenty-Seven Years Later. *Archaeology in Montana* 36(1):37-92.

1999 *Numa Origins: A Rocky Mountain Perspective.* Paper presented at the 4th Biennial Rocky Mountain Anthropological Conference, Glenwood Springs, Colorado, October 2, 1999.

2000 Personal Communication

2002 Archaeology in the Middle Rocky Mountains: Myopia, Misconceptions and Other Concerns. *Plains Anthropologist* 47:379-386.

Husted, W.M and R. Edgar

2002 *The Archeology of Mummy Cave, Wyoming.* United States Department of the Interior National Park Service, Midwest Archaeological Center, Lincoln, Nebraska.

Huter, P.

2003 *Assessment of Changing Diet-Breadth at Southside Shelter*. Unpublished Masters thesis, Department of anthropology, University of Wyoming, Laramie.

Irwin, H., and C. Irwin

1961 Radiocarbon Dates from the LoDaisKa Site, Colorado. *American Antiquity* 27(1):114-115.

Jennings, J. D.

1957 *Danger Cave.* University of Utah, Anthropological Papers 27. University of Utah Press, Salt Lake City.

1964 The Desert West. In *Prehistoric Man in the New World,* pp. edited by J. D. Jennings and E. Norbeck, pp. 149-174. University of Chicago Press, Chicago.

Jepson, D.A., C.J. Zier, M. McFaul, K.L. Traugh, G.D. Smith, and W. Doering

1994 *Archaeological and Geomorphic Investigations along U.S. Highway 34 between Greeley and Kersey, Weld County, Colordo.* Centennial Archaeology Inc. and Laramie Soils Service. Prepared for the Colorado Department of Transportation, Denver.

Johnson, E.A.

1975 The Sullivan Site. *Saskatchewan Archaeology Newsletter* 49:9-15.

Johnson, A.M., J.F. Adkins, C. Beal, J. Beal, F. Irish, R.D. Lyons, H. Quinn, F. Rathbun, D. Rhodes, A. Sands, M.J. Tate, W.H. Tate, and J. Mobley-Tanaka
1997 *Archaeological Investigations at the Ken-Caryl Ranch, Colorado,* edited by R. F. Somer. Memoirs of the Colorado Archaeological Society No. 6.

Kay, Marvin
1998 The Great Plains Setting. In *Archaeology on the Great Plains*, edited by W. Raymond Wood, pp. 16-47. University Press of Kansas, Lawrence, Kansas.

Kelly, R.L.
1995 *The Foraging Spectrum*. Smithsonian Institution Press.

Kevinsen, B.E.
2013 *Terminal Transitions: An Analysis of Projectile Points from the Terminal Middle Period on the Northern Plains.* Unpublished Masters Thesis, Department of Archaeology and Anthropology, University of Saskatchewan, Saskatoon.

Keyser, J. D.
1986 Evidence for McKean Complex Plant Utilization. *Plains Anthropologist* 31(113): 225-236.

Keyser, James. D. and C. M. Davis
1984 Lightning Spring: 4000 Years of Pine Parkland Prehistory *Archaeology in Montana* 25(2- 3):1-64.

1985 Lightning Spring and Red Fox: McKean Research in the Grand River Drainage. In *McKean/Middle Plains Archaic: Current Research, Occasional Papers on Wyoming Archaeology Number 4*, edited by M. Kornfeld and L.C. Todd, pp. 123-136 . Wyoming Recreation Commission, Cheyenne.

1999 McKean Complex Projectile Point Typology and Function in the Pine Parklands. *Plains Anthropologist* 44(169):251-270.

Keyser, J.D. and J.R. Wettstaed
1995 *Lightning Strikes Again: Excavation of Additional McKean Levels at the Lightning Spring Site, 39HN204.* Vol. 36, No. 1. Archaeology in Montana. ARC Archive No: XAS-0001.

Kooyman, B.P.
2000 *Understanding Stone Tools and Archaeological Sites.* University of Calgary , Calgary.

Kornfeld, M.
1995 McKean Site: Conclusions, Significance, Impacts, and Recommendations. In *Keyhole Reservoir Archaeology: Glimpses of the Past From Northewast Wyoming,* edited by M. Kornfeld, G.C. Frison and M.L. Larson, pp. 305-314. Occasional Papers in Wyoming Archaeology 5, Office of the Wyoming State Archaeologist, Laramie.

Kornfeld, M. and G.C. Frison
1985 McKean Site: A 1983 Preliminary Analysis. In *McKean/Middle Plains Archaic: Current Research, Occasional Papers on Wyoming Archaeology, Number 4,*edited by M. Kornfeld and L.C. Todd, pp. 31-44. Wyoming Recreation Commission, Cheyenne.

Kornfeld, M., G.C. Frison, and M. Larson
2010 *Prehistoric Hunters of the High Plains*. 2nd ed. Academic Press, San Diego.

Kvamme, K. L.
1990 Spatial Autocorrelation and the Classic Maya Collpse Revisited: Refined Techniques and New Conclusions. *Journal of Archaeological Science* 17:197-207.

Lahren, L.A.
1976 *The Myers-Hindman Site: An Exploratory Study of Human Occupation Patterns in the Upper Yellowstone Valley from 7000 B.C. to A.D. 1200*. Unpublished Doctoral Dissertation, Department of Archaeology, University of Calgary, Alberta.

Lamore, S.
2002 *McKean Complex Projectile Point Variability: Interaction and Mobility During the Middle Archaic.* Unpublished Masters Thesis, Department of Social Sciences, University of Denver.

Larson, M.L.
1997 Housepits and Mobile Hunter-Gatherers: A Consideration of the Wyoming Evidence. *Plains Anthropologist* 42(161): 353-369.

Leyden, J.J., L.I. Wassenaar, K.A. Hobson, E.G. Walker
2006 Stable Hydrogen Isotopes of Bison Bone Collagen as a Proxy for Holocene Climate on the Northern Great Plains, *Palaeogeography, Palaeoclimatology, Palaeoecology,* 239:87-99.

Lister, R.H.
1953 The Stemmed, Indented Base Point, A Possible Horizon Marker. *American Antiquity* 18:265.

Llobera, M.
1999 Understanding Movement: A Pilot Model Towards the Sociology of Movement. In *Beyond the Map: Archaeology and Spatial Technologies*, edited by G.R. Lock, pp. 65-84. IOS Press, Amsterdam.

Lloyd, C.D., and P.M. Atkinson
2004 Archaeology and Geostatistics . *Journal of Archaeological Science* 31:151-165.

Lobdell, J.E.
1973 The Scoggin Site: An Early Middle Period Bison Kill. *The Wyoming Archaeologist* 16(3-4):1-71.

Mack, L.
2000 *The Thundercloud Site (FbNp-25): An Analysis of a Multi-Component Northern Plains Site and the Role of Geoarchaeology in Site Interpretation.* Unpublished Masters Thesis, Department of Anthropology and Archaeology, University of Saskatchewan, Saskatoon.

Malasiuk, J.
2007 *Historical Resources Mitigation of EhPm-113 for the Panorama North Lands Neighborhood in SE-33-25-1-W5M (Permit 07-316): Final Report.* Archaeological Survey of Alberta. Permit No. 2007-316. Copies available from Archaeological Survey of Alberta, Edmonton.

MacDonald D.H.
1999 Modeling Folsom Mobility, Mating Strategies, and Technological Organization in the Northern Plains. *Plains Anthropologist* 44(168):141-161.

MacDonellG.H. and L. Wandersnider
2003 The western Niobrara River: An inter-island passage on the Plains. In *Island on the Plains*, edited by M. Kornfeld and A.J. Osborn, pp. 89-107. University of Utah Press, Salt Lake City.

MacNeish, R.S.
1958 *An Introduction to the Archaeology of Southern Manitoba.* Department of Northern Affairs and Indian Development Bulletin 157. National Museums of Canada, Ottawa.

McClelland, B.R. and W. Martin
1999 Section 8 – The Natrona Housepit Site (Site 48NA2526). In *Archaeological Investigations Along the Wyoming Segment of the Express Pipeline. Volume 4: Wind River and Casper Arch Sites*. TRC Mariah Associates Inc.

McFaul, M., K.L. Traugh, G.D. Smith, W. Doering, and C.J. Zier
1994 Geoarchaeologic Analysis of South Platte River Terraces: Kersey, Colorado. *Geoarchaeology* 9(5):345-374.

Malouf, C.
1960 A Brief Inventory of Specimens and Features of Montana Prehistory. *Archaeology in Montana* 2(2):2-18.

Martin, J.E., R.A. Alex, L.M. Alex, J.P. Abbott, R.C. Benton, and L.F. Miller
1993 The Beaver Creek Shelter (39CU779): A Holocene Succession in the Black Hills of South Dakota. In *Prehistory and Human Ecology of the Western Prairies and Northern Plains,* edited by J.A. Tiffany, pp. 17-36. Plains Anthropologist Memoir 27.

Mayer-Oakes, W.J.
1970 *Archaeological Investigations in the Grand Rapids, Manitoba, Reservoir 1961-1962.* Occasional Paper No. 3, Department of Anthropology, University of Manitoba.

McKern, W.C.
1939 The Midwestern Taxonomic Method as an Aid to Archaeological Cultural Study. *American Antiquity* 4(4): 301-313.

Mellars, P.
2006 A new radiocarbon revolution and the dispersal of modern humans in Eurasia. *Nature* 439:931-935.

Metcalf, M.D.
1974 *Archaeological Excavations at Dipper Gap: A Stratified Butte Top Site in Northeastern Colorado*. Unpublished Masters Thesis. Department of Sociology and Anthropology, Colorado State University, Fort Collins.

Meyer D. and M. Rollans
1990 The Case for (Canadian) Besant Pottery. Paper presented at the 31st Annual Meeting of the Western Association of Sociology and Anthropology. Morley, Alberta.

Meyer D. and D. Walde
2009 Rethinking Avonlea: Pottery Wares and Cultural Phases. *Plains Anthropologist.* 54(209):49-73.

Miller, M.E.
1985 Interassemblage Variability Among Five Middle Plains Archaic Bison Kills. In *McKean/Middle Plains Archaic: Current Research,* edited by M. Kornfeld and L.C. Todd. Occasional Papers on Wyoming Archaeology, Number 4.

Moerman, D.E.
2010 *Native American Ethnobotany*. Timber Press, Portland, London.

Morlan, R.
n.d. Canadian Archaeological Radiocarbon Database. Record on file, Canadian Museum of Civilization, Gatineau, Quebec.

1993 A Compilation and Evaluation of Radiocarbon Dates in Saskatchewan. *Saskatchewan Archaeology* 13:3-84.

Morris, E.A., R.C. Blakeslee, and K. Thompson
1985 Preliminary Description of McKean Sites in Northeastern Colorado in *McKean/Middle Plains Archaic Current Research,* edited by M. Kornfeld and L.C. Todd, pp. 11-20. Occasional Papers on Wyoming Archaeology No. 4.

Mulloy, W.
1954 The McKean Site in Northeastern Wyoming. *Southwestern Journal of Anthropology* 10(4):432-460.

1958 *A Preliminary Historical Outline for the Northwestern Plains.* University of Wyoming Publications in Science, Laramie.

Munson, G.
1992 A Late McKean Complex Occupation at 24RB1164. *Archaeology in Montana* 33(2):1-15.

Neal, B.S.
2006 *Precontact utilization of sandhill environments during the Pelican Lake and Besant phases.* Unpublished Master's thesis, Department of Archaeology, University of Saskatchewan, Saskatoon.

Novecosky, B.
1999 A Summary of Besant Communal Bison Hunting. *Manitoba Archaeological Journal* 9(1):113-118.

Osborn, Alan, J. and Marcel Kornfeld
2003 Biogeographical Islands and Ecological Patches: Seeing the Great Plains from the Inside Out. In *Islands on the Plains: Ecological, Social, and Ritual Use of Landscapes*, edited by M. Kornfeld and A. J. Osborn, pp. 1-20. The University of Utah Press, Salt Lake City, Utah.

Peck, Trevor R.
2011 *Light from Ancient Campfires: Archeological Evidence for Native Lifeways on the Northern Plains.* Athabasca University Press, Edmonton.

Pinhasi, R., J. Fort, and A.J. Amemerman
2005 Tracing the Origin and Spread of Agriculture in Europe. *PLoS Biology* 3(12):e410.

Pletz, J.R.
2010 *Archaeological Investigations at the Dog Child Site (FbNp-24): An Evaluation of Mummy Cave Subsistence Patterns.* Unpublished Master's thesis, Department of Archaeology and Anthropology, University of Saskatchewan, Saskatoon.

Price, M.H.
2010 *Mastering ArcGIS*. McGraw-Hill, Dubuque, IA.

Quigg, J.M.
1986 *The Crown Site (FhNa-86) Excavation Results.* Nipawin Reservoir Heritage Study, Volume 9, edited by D. Meyer, pp. 1-261. Saskatchewan Research Council, Publication No. E-903-7-E-86, Saskatoon.

Ramsey, C.L.
1993 *The Redtail Site: A McKean Habitation in South Central Saskatchewan*. Unpublished Master's thesis, Department of Anthropology and Archaeology, University of Saskatchewan, Saskatoon.

Rathbun, F.C.
1991 *Swallow Site 5JF321, Hogback Valley, Jefferson County, Colorado: Third Interim Report.*MS. on file, Denver Chapter, Office of Archaeology and Historic Preservation, Colorado Historical Society, Denver.

Reeves, B.O.K.
1969 The Southern Alberta Paleo-Cultural Paleo-Environmental Sequence. In *Post-Pleistocene Man and his environment on the Northern Plains*, edited by R.G. Forbis, L.B. Davis, O.A. Christensen, and G. Fedirchuk, pp. 6-46. University of Calgary Archaeological Association, Calgary.

1970 *Culture Change on the Northern Plains, 1000 B.C. – A.D. 1000*. Unpublished PhD Dissertation, Department of Archaeology, University of Calgary, Calgary.

1972 *The Archaeology of Pass Creek Valley, Waterton Lakes National Parks.* National Historic Sites Service. Manuscript Report No. 61. National and Historic Parks Branch, Department of Indian Affairs and Northern Development.

1973 The Concept of the Altithermal Cultural Hiatus in Northern Plains Prehistory. *American Anthropologist* 75(5):1221-1253.

1983 *Culture Change in the Northern Plains: 1000 B.C. – A.D. 1000*. Archaeological Survey of Alberta, Occasional Paper No. 20. Alberta, Historical Resources Division, Edmonton.

1996 Communal Bison Hunters of the Northern Plains. In *Hunters of the Recent Past,* edited by L.B. Davis and B. Reeves. Unwin Hyman: London.

Reher, C.A., G.M. Zeimens and G.C. Frison
1985 The Cordero Site – 48CA75: A Middle Plains Archaic Bison Processing Station in the Central Powder River Basin. In *McKean/Middle Plains Archaic: Current Reseaarch, Occasional Papers on Wyoming Archaeology Number 4*, edited by M. Kornfeld and L.C. Todd, pp. 109-121. Wyoming Recreation Commission, Cheyenne.

Renfrew, C. and P. Bahn
2004 *Archaeology: Theories, Methods and Practice*. 4th Edition. Thames & Hunson Ltd., London.

Rennie, P.J. and T.S. Hughes
1998 Archaeological Investigations at the Quinn Creek Site. *Archaeology in Montana* 39(2):1-66.

Richardson, C.
1974 Summary of Excavations at the Ken-Caryl Ranch, 1973. *Southwestern Lore* 40(3-4):49.

Rodriguex-Iturbe, I., R. Muneepeerakul, E. Bertuzzo, S.A. Levin, and A. Rinaldo
2009 River networks as ecological corridors: A complex systems perspective for integrating hydrologic, geomorphologic, and ecologic dynamics. *Water Resource Research* 45:W01413.

Roosevelt, A.C., J. Douglas, and L. Brown
2002 The Migrations and Adaptations of the First Americans: Clovis and Pre-Clovis Viewed from South America. In *The First Americans: The Pleistocene Colonization of the New World,* edited by N.G. Joblonski, pp. 159-235. University of California Press, San Francisco.

Roper, D.C.
1976 A Trend-Surface Analysis of Central Plains Radiocarbon Dates. *American Antiquity*, 41(2):181-189.

Ruebelmann, G.N.
1982 *An Archaeological Study of the Lewistown BLM District*. Bureau of Land Management, Lewistown, Montana.

Sappington, R.L.
1984 Procurement without Quarry Production: Examples from Southwestern Idaho. In *Prehistoric Quarries and Lithic Production,* edited by J.E. Ericson and B.A. Purdy, pp. 23-34. Cambridge University Press, New York.

Shay, T.C.
1980 Food Plants of Manitoba. In *Directions in Manitoba Prehistory: Papers in Homour of Chris Vickers,* edited by L. Pettipas, pp. 233-290. Association of Manitoba Archaeologists and the Manitoba Archaeological Society, Winnipeg.

Schmits, L.J.
1978 The Coffey Site: Environment and Cultural Adaptation at a Prairie Plains Archaic Site. *Midcontinental Journal of Archaeology* 3(1): 69-185.

Sheehan, M.S.
1995 Cultural Responses to the Altithermal or Inadequate Sampling? *Plains Anthropologist* 40: 261-270.

Shelford, V.E.
1963 [1978] *The Ecology of North America.* Urbana: University of Illinois Press.

Simpson, C.W., K.W. Scott, G.M. Zeimans, W. Miller, J. Bedord, C. Jefferson, R. Hilman, J. Jameson, and G.C. Frison
1984 Artifact and Feature Descriptions in The Dead Indian Creek Site: An Archaic Occupation in the Absaroka Mountains of Northeastern Wyoming. *The Wyoming Archaeologist* 27(1-2): 23-50.

Smith, N.
2012 *Archaeological Investigations at the Cut Arm Site (FbNp-22): Evidence for Wanuskewin Heritage Park as an Island on the Plains.* Unpublished Master's thesis. Department of Archaeology and Anthropology, University of Saskatchewan, Saskatoon.

Smith, S.K.
1970 A Preliminary Report on the Dead Indian Site: Site Number – 48PA551. *The Wyoming Archaeologist,* 13(1):23-33.

Spurling, B. and Ball, B.
1981 On Some Distributions of the Oxbow "Complex". *Canadian Journal of Archaeology* 5:89-102.

Steege, L.C. and D.G. Paulley
1964 Lissolo Cave Site. *The Wyoming Archaeologist* 7(2):25-31.

Stahl, P.W.
1996 Holocene Biodiversity: An Archaeological Perspective from the Americas. *Annual Review of Anthropology* 25:105-126.

Stine, E., T. Madigan, A. Kulevsky, C.A. Dobbs, and R. Schirmer
2001 *Alliance Pipeline L.P.: Excavations at 32MH94, McHenry County, North Dakota*. Report of Investigation Number 615. Document on file NDSHPO. Hemisphere Field Services, Inc., Minneapolis.

Strahler, A., and O.W. Archibold
2008 *Physical Geography: Science and Systems of the Human Environment Canadian Edition.* 4th ed. John Wiley & Sons, Inc.

Strong, W.D.
1935 An Introduction to the Study of Nebraska Archaeology. *Smithsonian Collections* 93(10).

Stuart, G.S.L.
1990 *The Cranford Site (DlPb-2): A Multi-component Stone Circle Site on the Oldman River.* Archaeological Survey of Alberta Manuscript Series No. 17, Edmonton.

Styles, B.W.
1994 1994 Excavations at Ice Cave. Paper presented at the Third Annual Island in the Plains Black Hills Symposium, Lead, South Dakota.

Syms, L.
1969 *The McKean Complex as a Horizon Marker in Manitoba and on the Great Northern Plains.* Unpublished Masters Thesis. Department of Anthropology, University of Manitoba, Winnipeg.

1970 The Complex in Manitoba. In *Ten Thousand Years: Archaeology in Manitoba,* edited by W.M. Hlady, pp. 123-138. Manitoba Archaeological Society. D.W. Friesen and Sons Ltd., Altona, Manitoba.

Tamplin, M.
1977 *Prehistoric occupation and resource use on the Saskatachewan River at The Pas, Manitoba.* Unpublished Ph.D. dissertation, Department of Anthropology, University of Arizona, Tucson.

Thomas, D.H.
1983 The Archaeology of Monitor Valley: 1. Epistemology. In *Anthropological Papers of the American Museum of Natural History,* vol. 58, Part 1. New York.

Toom, D.L. and M.L. Gregg (editors)
1983 *Archeological Excavations at the Mondrian Tree Site (32MZ58), Missouri River, McKenzie County, North Dakota: Final Report.* Report Prepared for the Northern Border Pipeline Company, Omaha, Nebraska.

Tratebas, A.M.
1998 Reexamining the Plains Archaic McKean Culture. In *Explorations in American Archaeology: Essays in Honor of Wesley R. Hurt,* edited by M.G. Plew, pp.. 259-309. University Press of American, Inc., Lanham.

Thompson, K.
1986 *Phoebe Rockshelter: A Multi-Component Site in North Central Colorado.* Unpublished Master's thesis, Department of Anthropology, Colorado State University, Fort Collins.

Trimble, D.E.
1980 *The Geologic Story of the Great Plains.* Geological Survey Bulletin 1493. United States Government Printing Office, Washington.

Vance, R.E., D. Emerson and T. Habgood
1983 A Mid-Holocene Record of Vegetative Change in Central Alberta. *Canadian Journal of Earth Sciences* 20:364-376.

Vance, R.E., A.B. Beaudoin, and B.H. Luckman
1995 The Paleoecological Record of 6 KA BP Climate in the Canadian Prairie Provinces. *Geographie Physique et Quaternaire* 49(1): 81-98.

Van Dyke, S.
1993 *Archaeological Site Mitigation, Pt. SE 4-26-4-W5M, EhPo-54 and PhOp-55, Archaeological Survey: Final Report, Permit 93-012.* Archaeological Survey of Alberta. Permit No. 1993-012. Edmonton, Alberta.

1994 *Oldman River Dam Prehistoric Archaeology Mitigation Program, Technical Series No. 1: Campsites Study, 1988-1991 (Permits 88-39, 89-25, 90-25, 91-50).* Archaeological Survey of Alberta. CRM 100. Alberta, Edmonton.

Varsakis, I.
2006 *Besant Revisited: The Fincastle Site (DiO-5) and Archaeological Cultures on the Northwestern Plains, 2500 BP – 1250 BP.* Unpublished Masters Thesis, Department of Geography, University of Lethbridge.

Vivian, B.C., A. Dow, and B.O.K. Reeves
2005 *Historical Resources Conservation Excavations, EgPn 430, Vol. 1: Areas Two and Three: Final Report (Permit 2003-097).* Archaeological Survey of Alberta. Permit No. 2003-097. Edmonton, Alberta.

Wackernagel, H.
1998 *Multivariate geostatistics: An introduction with applications,* 2nd edition. Springer-Verlag.

Walde, D.
2006 Sedentism and Pre-contact Tribal Organization on the Northern Plains: Colonial Imposition or Indigenous Development. *World Archaeology* 38(2):291-310.

Walde, D., D. Meyer, and W. Unfreed
1995 The Late Period on the Canadian and Adjacent Plains. *Journal of American Archaeology* 9:10-66.

Walker, E.G.
1982 The Bracken Cairn: A Late Middle Archaic Burial from Southwestern Saskatchewan. *Saskatchewan Archaeology* 3:8-35.

1983 *Archaeological Resource Assessment: The Tipperary Creek Project*. Westek Consulting Limited, Saskatoon.

1984 The Graham Site: A McKean Cremation from Southern Saskatchewan. *Plains Anthropologist* 29(104):139-150.

1992 *The Gowen Sites: Cultural Responses to Climtic Warming on the Northern Plains (7500-5000 B.P.).* Archaeological Survey of Canada Mercury Series Paper 145. Canadian Museum of Civilization, Hull.

1999 Precontact Archaeology of Southern Saskatchewn. In *Atlas of Saskatchewan.* 2nd ed. edited by K. Fung, p. 25-27. University of Saskatchewan, Saskatoon.

2015 Personal communication.

Walker, D.N. and G.C. Frison
1984 Conclusions. In The Dead Indian Creek Site: An Archaic Occupation in the Absaroka Mountains of Northeastern Wyoming, G.C. Frison and D.N. Walker (eds.). *The Wyoming Archaeologist* 27(1-2):111-114.

Webb, W.P.
1931 *The Great Plains.* Ginn & Company, Boston.

Webster, S.M.
1999 *Interpreting Northern Plains Subsistence Practices: An Analysis of the Faunal and Floral Assemblages From the Thundercloud Site (FbNp-25).* Unpublished Master's thesis, Department of Archaeology, University of Saskatchewan, Saskatoon.

2004 *A Re-Evaluation of the McKean Series on the Northern Plains*. Unpublished PhD dissertation, Department of Anthropology and Archaeology, University of Saskatchewan, Saskatoon.

Wedel, W.R.
1961 The Great Plains. In *Prehistoric Man in the New World,* edited by J. D. Jennings and E. Norbeck, pp. 149-74. University of Chicago Press, Chicago.

1964 The *Prehistoric Man on the Great Plains.* University of Oklahoma Press, Norman, Oklahoma.

1978 The Prehistoric Plains. In *Ancient Native Americans,* edited by J.D. Jennings, p. 183-219. W.H. Freeman, San Francisco.

Wedel, W.R., W.M. Husted and J.H. Moss
1968 Mummy Cave: Prehistoric Record from Rocky Mountains of Wyoming. *American Association for the Advancement of Science* 160(3824):184-186.

Wedel, W.R. and G.C. Frison
2001 Environment and Subsistence. In *Handbook of North American Indians* Vol. 13 (1) pp. 44-60, volume edited by R.J. DeMallie Smithsonian Institution, Washington.

Weissner, P.
1983 Style and Social Information in Kalahari San Projectile Points. *American Antiquity* 48:253-276.

Wettlaufer, B.
1955 *The Mortlach Site in the Besant Valley of Central Saskatchewan.* Anthropological Series No. 1. Department of Natural Resources, Regina, Saskatchewan.

1981 The Oxbow Complex in Time and Space: (Forward). *Canadian Journal of Archaeology* 5:79-81.

Wettlaufer, B.N. and W.J. Mayer-Oakes
1960 *The Long Creek Site.* Department of Natural Resources, Anthropological Series No. 2. Lawrence Amon, Regina.

Wheatley, D. and M. Gillings
2002 *Spatial Technology and Archaeology: The Archaeological Applications of GIS*. Taylor & Francis, New York.

Wheeler, R.P.
1952 A Note on the "McKean Lanceolate Point". *Plains Anthropological Conference Newsletter* 4(4):39-44.

1954 Two New Projectile Point Types: Duncan and Hanna Points. *Plains Anthropologist* 1:7-14.

1985 The Middle Prehistoric period in the Central and Northern Plains. In *McKean/Middle Plains Archaic: Current research*, edited by M. Kornfeld and . C. Todd, pp. 5-10. Occasional Papers on Wyoming Archaeology No. 4. Wyoming Recreation Commission, Cheyenne.

1995a *Archaeological Investigations in Three Reservoir Areas in South Dakota and Wyoming: Part I Angostura Reservoir, Volume 46.* Reprints in Anthropology 46, J & L Reprint Company, Lincoln.

1995b *Archaeological Investigations in Three Reservoir Areas in South Dakota and Wyoming: Part II Keyhole Reservoir, Volume 47.* Reprints in Anthropology 47, J & L Reprint Company, Lincoln.

1995c *Archaeological Investigations in Three Reservoir Areas in South Dakota and Wyoming: Part III Boysen Reservoir, Volume 49.* Reprints in Anthropology 47, J & L Reprint Company, Lincoln.

Wiken, E., F.J. Nava, and G. Griffith
2011 *North American Terrestrial Ecoregions – Level III*. Commission for Environmental Cooperation, Montreal, Canada.

Willey, G.R. and P. Phillips
1958 *Method and Theory in American Archaeology*. The University of Chicago Press, Chicago.

Wilson, M.
1983 Canid Scavengers and Butchering Patterns: Evidence from a 3600 Year Old Bison Bone Bed in Alberta. In *Carnivores, Human Scavengers, and Predators: A Question of Bone Technology,* edited by G.M. LeMoine, and A.S. MacEachern, pp. 95-139. Proceedings of the 15th Annual Chacmool Conference, Chacmoool Archaeology Association, University of Calgary, Calgary.

1984 The Dead Indian Creek Site and its Environment in The Dead Indian Creek Site: An Archaic Occupation in the Absaroka Mountains of Northeastern Wyoming. *The Wyoming Archaeologist* 27(1-2):15-22.

Wood, R.
1998 Introduction in *Archaeology on the Great Plains,* edited by R.Wood. University Press of Kansas, Lawrence, Kansas.

Wormington, H.M., and R.G. Forbis
1965 *An Introduction to the Archaeology of Alberta, Canada.* Proceedings No 11, Denver Museum of Natural History, Denver, Colorado.

Wright, J.V.
1995 *A History of the Native People of Canada. Vol. I (10000-1000 BC).* Mercury Series No. 152. Canadian Museum of Civilization, Hull, Quebec.

Yansa, C.H.
2007 Lake Records of Northern Plains Paleoindian and Early Archaic Environments: The "Park Oasis" Hypothesis. *Plains Anthropologist* 52(201):109-144.

Data Sources

McKean Sites Saskatchewan [excel]. Archaeology Resource Management Saskatchewan, (ARMS 2012) 2012.

McKean Sites Alberta [excel]. Archaeological Survey of Alberta, 2012.

North American DEM [dem]. ESRI, 2008. Available: ArcGIS <http://www.arcgis.com/> (September 2012).

North American Administrative Boundaries [shapefile]. ESRI 2008. Available: ArcGIS <http://www.arcgis.com/> (September 2008).

North American Ecoregions [shapefile]. ESRI 2008. Available: ArcGIS <http://www.arcgis.com/> (September 2013).

North American Ecozones [shapefile]. Commission for Environmental Cooperation, 2011. Available CEC < http://www.cec.org/Page.asp?PageID=122&ContentID=2336> (September 2012).

North American Waterbodies [shapefile]. ESRI 2008. Available: ArcGIS <http://www.arcgis.com/> (September 2012).

Appendix A. Complete Radiocarbon Database

Site Name	Site #	Context	Associated Points	Date B.P. (Lab #)	Material	Lab No.	Source
	EaPk-201	West block, CU-2	H	3720 +/- 260	Bone	S-3984	Brumley 1975; Morlan n.d.
	EaPk-201	West block, CU-3	H	3860 +/- 320	Bone	S-3985	Brumley 1975; Morlan n.d.
	EgPn-430	Area 2	H/L, mixed	3580 +/- 70	Bone	BETA-126647	Vivian et al 2005
	EgPn-467	Upper component	D/H/L	3330 +/- 90	Bone	BETA1151	Hanna and Head 2000
	Ehpm-113	Horizon 2	H	2880 +/- 40	Bone	BETA2361	Malasiu 2007
	EiPo-51	Single component	H	3680 +/- 75	Bone	BETA-1672	Wilson 1983; Morlan n.d.
	EgNo-23	Occupation 2a	H	3348 +/- 50	Bone	BGS-2363	Webster 2004
	EgNo-23	Occupation 2b	H	3430 +/- 40	Bone	Beta16731	Webster 2004
	EgNo-23	Level 2	H	3440 +/- 55	Bone	BGS-2364	Webster 2004
	EgNo-23	Level 3	L	4140 +/- 60	Bone	Beta18352	Webster 2004
24RB1164	24RB1164	Task Area 4	D/H/M	3310 +/- 90	Bone	Beta-35225	Munson 1992
5WL48	5WL48	Feature 12	D	3230 +/- 80	Charcoal	Beta-48810	Gilmore et al. 1999; Jepson et al. 1994; McFaul et al. 1994
Austech	EhPo-55	30-60 cm	H/L	3400 +/- 60	Bone	AECV155C	Van Dyke 1993
Austech	EhPo-55	30-60 cm	H/L	3540 +/- 60	Bone	AECV134C	Van Dyke 1993
Bayou Gulch	5DA265	Feature 14	D/H/L/M	3410 +/- 70	Charcoal	DIC-1508	Butler 1981; Gilmore et al. 1999
Beaver Creek Shelter	39CU77	Unit 11	L	3870 +/- 70	Charcoal	Beta-13827	Tratebas 1998
Beaver Creek Shelter	39CU77	Unit 13	L	4010 +/- 100	Charcoal	Beta-19060	Tratebas 1998
Benson's Butte	24BH1726	Middle Archaic Level	D/H/L/mixed	4230 +/- 50	Charcoal	TX-2797	Fredlund 1979
Billett Site No. 2	EkNv-36	Area o-3	H	3100 +/- 60	Bone	S-2054	Dyck 1983
Billett Site No. 2	EkNv-36	Area o-2	H	3470 +/- 120	Charcoal	S-2063	Dyck 1983
Bottleneck Cave	48BH20	Occupation IV	D/H/L	3820 +/- 200	Charcoal	SI-239	Husted 1962
Boy Chief	EeOv-68	B4, Occ. 3	H	3360 +/- 80	Bone	AECV2024	Head et al. 2003
Boy Chief	EeOv-68	B4, Occ. 3	H	3400 +/- 90	Bone	AECV2053	Head et al. 2003
Bradford House II	5JF51	Hearth	D	3255 +/- 765	Charcoal	UGA-4000	Gilmore et al. 1999; Johnson et al. 1997; Richardson 1974;

Site Name	Site #	Context	Associated Points	Date B.P. (Lab #)	Material	Lab No.	Source
Cactus Flower	EbOp-16	Occupation IIIV	D/H/L	4220 +/- 130	Charcoal	S-1210	Brumley 1975; Morlan n.d.
Cactus Flower	EbOp-16	Occupation IIIV	D/H/L	4130 +/- 85	Charcoal	S-782	Brumley 1975; Morlan n.d.
Cactus Flower	EbOp-16	Occupation VI	D/H	3970 +/- 160	Bone	S-820	Brumley 1975; Morlan n.d.
Cactus Flower	EbOp-16	Occupation VI	D/H	3615 +/- 95	Charcoal	S-823	Brumley 1975; Morlan n.d.
Cactus Flower	EbOp-16	Occupation LIV	D/H/L	3705 +/- 80	Bone	S-784	Brumley 1975; Morlan n.d.
Cactus Flower	EbOp-16	Occupation LIV	D/H/L	3620 +/- 95	Charcoal	S-822	Brumley 1975; Morlan n.d.
Cactus Flower	EbOp-16	Occupation LIII	D/H	3930 +/- 110	Charcoal	S-1013	Brumley 1975; Morlan n.d.
Cherry Point	DkMe-10	Occupation A	D/H	1020 +/- 110	Bone	S-1033	Balcom 1976, Haug 1975
Cherry Point	DkMe-10	Occupation B	D/H/mixed	1850 +/- 100	Bone	S-1031	Balcom 1976, Haug 1975
Cherry Point	DkMe-10	Occupation B	D/H/mixed	2060 +/- 130	Bone	S-1032	Balcom 1976, Haug 1975
Cherry Point	DkMe-10	Occupation C	D/H/mixed	2830 +/- 260	Bone	S-1030	Balcom 1976, Haug 1975
Cherry Point	DkMe-10	Occupation C	D/H/mixed	2860 +/- 210	Bone	S-1029	Balcom 1976, Haug 1975
Cordero Mine	48CA75	Area 1	D/H	3520 +/- 150	Charcoal	RL-805	Reher et al. 1985
Crown site	FhNa-86	East	L	3825 +/- 90	Bone	S-2369	Quigg 1986
Crown site	FhNa-86	West	L	4180 +/- 115	Bone	S-2290	Quigg 1986
Crown site	FhNa-86	Hab b/L4e	H	3330 +/- 110	Bone	S-2292	Quigg 1986
Crown site	FhNa-86	Hab b/L6e	H	3600 +/- 80	Bone	S-2291	Quigg 1986
Crown site	FhNa-86	Hab b/L6e	H	3425 +/- 105	Bone	S-2554	Quigg 1986
Crown site	FhNa-86	Hab b/L3w	H	3605 +/- 120	Bone	S-2556	Quigg 1986
Crown site	FhNa-86	East	L	4330 +/- 115	Bone	S-2520	Quigg 1986
Crown site	FhNa-86	East	L	3825 +/- 75	Bone	S-2521	Quigg 1986
Crown site	FhNa-86	West	L	4295 +/- 85	Bone	S-2525	Quigg 1986
Crown site	FhNa-86	Level 8, east	L	3995 +/- 80	Bone	S-22526	Quigg 1986
Cut Arm site	FhNa-86	Leve 8, upper	L	3387 +/- 50	Bone	BGS-238	Webster 2004
Cut Arm site	FhNa-86	Level 8, lower	L	3448 +/- 60	Bone	BGS-2384	Webster 2004
Dead Indian Creek	48PA55	Area 1	D/L/mixed	3800 +/- 110	Charcoal	RL-321	Wilson 1984
Dead Indian Creek	48PA55	Area 1	D/L/mixed	4180 +/- 250	Charcoal	W-2597	Wilson 1984

Site Name	Site #	Context	Associated Points	Date B.P.	Material	Lab No.	Source
Dead Indian Creek	48PA55	Area 1	D/L/mixed	4430 +/- 250	Charcoal	W-2599	Wilson 1984
Dipper Gap	5LO101	Locality 1, Zone D, feature 16	D/H	3180 +/- 90	Charcoal	UGA-456	Gilmore et al. 1999; Metcalf 1974
Dipper Gap	5LO101	Locality 1, Zone D, feature 5	D/H	3410 +/- 90	Charcoal	UGA-453	Gilmore et al. 1999; Metcalf 1974
Dipper Gap	5LO101	Locality 1, Zone D, feature 10	D/H	3520 +/- 85	Charcoal	UGA-455	Gilmore et al. 1999; Metcalf 1974
Dog Child	FbNp-24	Level 2a	D/H/L	3460 +/- 45	Bone	BGS-2660	Pletz 2010
Falcon's Nest	5JF211	67-70 BGS	D/H/L/M/ mixed	2760 +/- 110	Charcoal	Beta-17605	Adkins 1993; Gilmore et al. 1999
Gant Site	39ME9	Unit III	D/H/L/mixed	4130 +/- 130	Charcoal	n/a	Keyser and Davis 1999
George Hey	39FA30	Feature 6	D/L	3520 +/- 70	Charcoal	WIS-1086	Tratebas 1998
George Hey	39FA30	Feature 9	D/L	3925 +/- 65	Charcoal	WIS-1065	Tratebas 1998
Graham II Site	FaNq-30	Burial	D/H/L	3245 +/- 50	Bone	S-1574	Walker 1984
Kinney Spring	5LR144	Site C, bank	L series	3250 +/- 80	Charcoal	Beta-6847	Gilmore et al. 1999; Morris et al. 1985
Kinney Spring	5LR144	Site C, L.87-97R.24F.9	L series	3800 +/- 70	Charcoal	Beta-7333	Gilmore et al. 1999; Morris et al. 1985
Kolterman	39FA68	Component B	L	3630 +/- 175	Charcoal	M-368	Wheeler 1995a
Kolterman	39FA68	Component B	L	4230 +/- 175	Charcoal	M-369	Wheeler 1995a
Leigh Cave	48WA30	Single occupation	D/H	4170 +/- 150	Charcoal	Grey no. 25	Frison and Huseas 1968
Lightning Spring site	39HN20	Stratum 8	D	3430 +/- 270	Charcoal	TX-4084	Keyser and Davis 1999
Lightning Spring site	39HN20	Stratum 9	D	4190 +/- 110	Charcoal	TX-4083	Keyser and Davis 1999
Lightning Spring site	39HN20	Stratum 10	D	3850 +/- 150	Charcoal	TX-4081	Keyser and Davis 1999
Lightning Spring site	39HN20	Stratum 10	D	3870 +/- 210	Charcoal	TX-4082	Keyser and Davis 1999
Lightning Spring site	39HN20	Stratum 12	D	4040 +/- 90	Charcoal	Beta-58280	Keyser and Davis 1999
Lightning Spring site	39HN20	Stratum 14	D	4200 +/- 170	Charcoal	Beta-58279	Keyser and Davis 1999
LoDaisKa	5JF142	Complex C	D/L	3150 +/- 100	Charcoal	m-1006	Gilmore et al. 1999; Irwin and Irwin 1961
LoDaisKa	5JF142	Complex C	D/L	3400 +/- 100	Charcoal	m-1004	Gilmore et al. 1999; Irwin and Irwin 1961
Long Creek site	DgMr-1	Level 5	H	3370 +/- 145	Charcoal	S-63a	Wettlaufer & Meyer-Oakes 1960

Site Name	Site #	Context	Associated Points	Date B.P.	Material	Lab No.	Source
Long Creek site	DgMr-1	Level 5	H	3375 +/- 55	Bone	BGS-2362	Webster 2004
Lunch Cave	5LR288	Feature 2	H	3085 +/- 60	Charcoal	UGA-1864	Gilmore et al. 1999
Malin Creek	24YE33	Feature c	H	4580 +/- 50	Charcoal	Beta-174888	Davis et al 2012
Malin Creek	24YE33	Feature e	H	5050 +/- 50	Charcoal	Beta-174889	Davis et al 2012
McKean	48CK7	Housepit hearth	D/H/L	3790 +/- 140	Charcoal	RL-1860	Kornfeld 1995; Kornfeld and Frison 1985
McKean	48CK7	Location 2, Block 1	D/H/L	4590 +/- 160	Charcoal	RL-1861	Kornfeld 1995; Kornfeld and Frison 1985
Medicine Lodge Creek	48BH499		D/H/L	3980 +/- 160	Charcoal	RL-96	Frison 1991:85
Medicine Lodge Creek	48BH499		D/H/L	4050 +/- 150	Charcoal	RL-438	Frison 1991:85
Meyers-Hindman	24PA504	Settlement Unit 4	D/H/L/mixed	3150 +/- 110	Bone	Gak2630	Lahren 1976
Meyers-Hindman	24PA504	Settlement Unit 4	D/H/L/mixed	3530 +/- 110	Charcoal	Gak2629	Lahren 1976
Mondrian Tree	32MZ58	Area A - Zone 7	D	3550 +/- 85	Charcoal	UCR-1324	Toom 1983
Mondrian Tree	32MZ58	Area A - Zone 7	D	3560 +/- 170	Charcoal	UCR-1326	Toom 1983
Mondrian Tree	32MZ58	Area A - Zone 7	D	3580 +/- 170	Charcoal	UCR-1325	Toom 1983
Mondrian Tree	32MZ58	Area A - Zone 7	D	3745 +/- 170	Charcoal	UCR-1323	Toom 1983
Mondrian Tree	32MZ58	Area A - Zone 7	D	4030 +/- 100	Charcoal	UCR-1322	Toom 1983
Mortlach	EcNl-1		D	3400 +/- 200	Bone	S-2	Wettlaufer 1956
Mummy Cave	48PA20	Layer 30	D/L	4090 +/- 140	Charcoal	I-1580	Morlan n.d
Mummy Cave	48PA20	Layer 30	D/L	4170 +/- 130	Charcoal	I-1582	Morlan n.d
Mummy Cave	48PA20	Layer 30	D/L	4375 +/- 180	Charcoal	I-1034	Morlan n.d
Mummy Cave	48PA20	Layer 30	D/L	4420 +/- 150	Charcoal	I-1428	Wedel et al. 1968
Natrona Housepit site	48NA2526	Middle Feature 4	D/H/L/mixed	3820 +/- 50	Charcoal	NA2526-4	McClelland and Martin 1999
Natrona Housepit site	48NA2526	Top Feature 4	D/H/L/mixed	3870 +/- 50	Charcoal	NA2526-3	McClelland and Martin 1999
Natrona Housepit site	48NA2526	Bottom Feature 4	D//H/Lmixed	3870 +/- 50	Charcoal	NA2526-5	McClelland and Martin 1999
Natrona Housepit site	48NA2526	Feature 4.3	D/H/L/mixed	3910 +/- 50	Charcoal	NA2526-7	McClelland and Martin 1999
Natrona Housepit site	48NA2526	Feature 4.2	D/H/L/mixed	3920 +/- 50	Charcoal	NA2526-6	McClelland and Martin 1999
Natrona Housepit site	48NA2526	Bottom Feature 4	D/H/L/mixed	4080 +/- 70	Charcoal	S-5-15-2	McClelland and Martin 1999
Natrona Housepit site	48NA2526	Feature 9	D/H/L/mixed	4840 +/- 50	Charcoal	NA2526-8	McClelland and Martin 1999

Site Name	Site #	Context	Associated Points	Date B.P.	Material	Lab No.	Source
Pack Rat Rockshelter	5LR170	11S13W, Feature 57	D/H/L	2480 +/- 90 (rejected)	Charcoal	Beta-2288	Gilmore et al. 1999; Morris et al. 1986
Pack Rat Rockshelter	5LR170	11S13W, Feature 51	D/H/L	2760 +/- 100	Charcoal	Beta-2286	Gilmore et al. 1999; Morris et al. 1987
Paint Rock V	48BH34	Unknown	D/H/L	4310 +/- 140	Charcoal	RL-482	Frison 1991
Pass Creek Cabin	DgPl-1	Occupation 1C	L, mixed	3860 +/- 215	Apatite	GX-1460	Brumley 1975; Morlan n.d.
Phoebe Rockshelter	5LR161	Level 3	D/H	3570 +/- 60	Charcoal	Beta-3869	Gilmore et al. 1999; Thompson 1986
Phoebe Rockshelter	5LR161	Level 3	D/H	3890 +/- 60	Charcoal	Beta-3870	Gilmore et al. 1999; Thompson 1986
Quinn Creek site	24JF110	XB:1	D/H	2830 +/- 90	Bone	Beta-11447	Rennie and Hughes 1998
Red Canyon Rockshelter	48CK1395	Component II	H/L	3260 +/- 80	Charcoal	Beta-3783	Tratebas 1998, on file WSHPO
Red Canyon Rockshelter	48CK1395	Component II	H/L	4440 +/- 60	Charcoal	Beta-81537	Tratebas 1998, on file WSHPO
Red Canyon Rockshelter	48CK1395	Component II	H/L	4550 +/- 130	Charcoal	Beta-73784	Tratebas 1998, on file WSHPO
Red Fox	32BO213	Level 4 east	D	3770 +/- 90	Charcoal	SI-479	Syms 1969
Red Tail site	FbNp-10	11	H	3580 +/- 80	Bone	S-3372	Ramsay 1993
Red Tail site	FbNp-10	12(1)	H	3470 +/- 80	Bone	S-3373	Ramsay 1993
Red Tail site	FbNp-10	12(2)	H	3660 +/- 75	Bone	S-3008	Ramsay 1993
Red Tail site	FbNp-10	13(2)	L	3860 +/- 70	Bone	S-3374	Ramsay 1993
Red Tail site	FbNp-10	13(2)	L	3880 +/- 70	Bone	S-3375	Ramsay 1993
Red Tail site	FbNp-10	13(4)	L	4280 +/- 80	Bone	S-3009	Ramsay 1993
Rigler Bluffs	24PA401	Hearth feature	L	4900 +/- 300	Charcoal	W-1135	Haines 1962
Rigler Bluffs	24PA401	Hearth feature	L	5040 +/- 150	Charcoal	Grey no 29	Haines 1962
Rock Creek site	5BL2712	Feature 20	D	3120 +/- 190	Charcoal	Beta-71550	Gilmore et al. 1999; Gleichman et al. 1995
Rock Creek site	5BL2712	Feature 22	D	3000 +/- 190	Charcoal	Beta-68172	Gilmore et al. 1999; Gleichman et al. 1995
Scoggin	48CR30	Single occupation	L/M	4540 +/- 110	Charcoal	L-3858	Lobdell 1974
Second Lake	EhPv-58	Occupation 6	H	3560 +/- 135	Charcoal	S-2778	Fedje 1986

Site Name	Site #	Context	Associated Points	Date B.P.	Material	Lab No.	Source
Second Lake	EhPv-58	Occupation 6	H	2540 +/- 120	Bone	S-2754	Fedje 1986
Signal Butte	25SF1	IC	H/L	4170 +/- 250	Charcoal	L-385D	Forbis 1985
Signal Butte	25SF1	1A	H/L	4550 +/- 220	Charcoal	L-385B	Forbis 1985
Sjovold site	EiNs-4	Layer XXI	H	3530 +/- 115	Bone	S-2062	Dyck and Morlan 1995
Snyder Farm Locality	DjPm-36	100-120 cm BS	H, mixed	3670 +/- 130	Bone	AECV-1190C	Van Dyke 1994
Sorenson	24CB202	Occupation V	D/mixed	4900 +/- 250	Charcoal	I-691	Ruebelmann 1982
Southsider Cave	48BH364	n/a	L	3900 +/- 140	Charcoal	RL-668	Frison 1991
Southsider Cave	48BH364	n/a	L	4170 +/- 150	Charcoal	RL-672	Frison 1991
Swallow site	5JF321	Feature 17	D/L,mixed	3440 +/- 90	Charcoal	Beta-44398	Gilmore et al. 1999; Rathbun 1991
Swallow Site	5JF321	Feature 107	D/L/mixed	3150 +/- 100	Charcoal	Beta-42288	Gilmore et al. 1999; Rathbun 1991
The Pas Reserve site	FbNp-5	Archaic component	D/H	3190 +/- 60	Charcoal	BGS-2369	Tamplin 1977
Thundercloud site	FbNp-25	5a	D/H/L	3150 +/- 50	Bone	BGS-2369	Webster 2004
Thundercloud site	FbNp-25	5b	D/H/L	3315 +/- 50	Bone	BGS-2367	Webster 2004
Thundercloud site	FbNp-25	5c	L	4040 +/- 90	Bone	BGS-3645	Webster 1999
Whitemouth Falls	EaLa-1	Level 2	L	3405 +/- 175	Bone	GX-4415	Buchner 1979

Appendix B. Radiocarbon Ages used for Model

Site Name	Site #	Context	Associated Points	Date B.P.	Material	Lab No.	Source
	EgPn-467	upper component	D/H/L	3330 +/- 90	Bone	BETA-1151	Hanna and Head 2000
	Ehpm-113	horizon 2	H	2880 +/- 40	Bone	BETA-2361	Malasiu 2007
	EiPo-51	single component	H	3680 +/- 75	Bone	BETA-1672	Wilson 1983, Morland n.d.
	EgNo-23	occupation 2a	H	3348 +/- 50	Bone	BGS-2363	Webster 2004
	EgNo-23	occupation 2b	H	3430 +/- 40	Bone	Beta-16731	Webster 2004
	EgNo-23	Level 2	H	3440 +/- 55	Bone	BGS-2364	Webster 2004
	EgNo-23	Level 3	L	4140 +/- 60	Bone	Beta-18352	Webster 2004
24RB1164	24RB1164	Task Area 4	D/H/M	3310 +/- 90	Bone	Beta-35225	Munson 1992
5WL48	5WL48	feature 12	D	3230 +/- 80	Charcoal	Beta-48810	Gilmore et al. 1999
Austech	EhPo-55	30-60 cm	H/L	3400 +/- 60	Bone	AECV-155C	Van Dyke 1993
Austech	EhPo-55	30-60 cm	H/L	3540 +/- 60	Bone	AECV-134C	Van Dyke 1993
Bayou Gulch	5DA265	Feature 14	D/H/L/M	3410 +/- 70	Charcoal	DIC-1508	Butler 1981; Gilmore et al. 1999
Beaver Creek Shelter	39CU77	Unit 11	L	3870 +/- 70	Charcoal	Beta-13827	Tratebas 1998
Beaver Creek Shelter	39CU77	Unit 13	L	4010 +/- 100	Charcoal	Beta-19060	Tratebas 1998
Billett Site No. 2	EkNv-36	area o-3	H	3100 +/- 60	Bone	S-2054	Dyck 1983
Billett Site No. 2	EkNv-36	area o-2	H	3470 +/- 120	Charcoal	S-2063	Dyck 1983
Bottleneck Cave	48BH20	Occupation IV	D/H/L	3820 +/- 200	Charcoal	SI-239	Husted 1962
Boy Chief	EeOv-68	B4, Occ. 3	H	3360 +/- 80	Bone	AECV-2024	Head et al. 2003
Boy Chief	EeOv-68	B4, Occ. 3	H	3400 +/- 90	Bone	AECV-2053	Head et al. 2003
Bradford House II	5JF52	hearth	D	3255 +/- 765	Charcoal	UGA-4000	Gilmore et al. 1999; Johnson et al. 1997; Richardson 1974
Cactus Flower	EbOp-16	Occupation IIIV	D/H/L	4220 +/- 130	Charcoal	S-1210	Brumley 1975; Morlan n.d.
Cactus Flower	EbOp-16	Occupation IIIV	D/H/L	4130 +/- 85	Charcoal	S-782	Brumley 1975; Morlan n.d.
Cactus Flower	EbOp-16	Occupation VI	D/H	3970 +/- 160	Bone	S-820	Brumley 1975; Morlan n.d.
Cactus Flower	EbOp-16	Occupation VI	D/H	3615 +/- 95	Charcoal	S-823	Brumley 1975; Morlan n.d.
Cactus Flower	EbOp-16	Occupation LIV	D/H/L	3705 +/- 80	Bone	S-784	Brumley 1975; Morlan n.d.
Cactus Flower	EbOp-16	Occupation LIV	D/H/L	3620 +/- 95	Charcoal	S-822	Brumley 1975; Morlan n.d.

Site Name	Site #	Context	Associated Points	Date B.P.	Material	Lab No.	Source
Cactus Flower	EbOp-16	Occupation LIII	D/H	3930 +/- 110	Charcoal	S-1013	Brumley 1975; Morlan n.d.
Cordero Mine	48CA75	Area 1	D/H	3520 +/- 150	Charcoal	RL-805	Reher et al. 1985
Crown site	FhNa-86	east	L	3825 +/- 90	Bone	S-2369	Quigg 1986
Crown site	FhNa-86	west	L	4180 +/- 115	Bone	S-2290	Quigg 1986
Crown site	FhNa-86	hab b/L4e	H	3330 +/- 110	Bone	S-2292	Quigg 1986
Crown site	FhNa-86	hab b/L6e	H	3600 +/- 80	Bone	S-2291	Quigg 1986
Crown site	FhNa-86	hab b/L6e	H	3425 +/- 105	Bone	S-2554	Quigg 1986
Crown site	FhNa-86	hab b/L3w	H	3605 +/- 120	Bone	S-2556	Quigg 1986
Crown site	FhNa-86	east	L	4330 +/- 115	Bone	S-2520	Quigg 1986
Crown site	FhNa-86	east	L	3825 +/- 75	Bone	S-2521	Quigg 1986
Crown site	FhNa-86	west	L	4295 +/- 85	Bone	S-2525	Quigg 1986
Crown site	FhNa-86	level 8, east	L	3995 +/- 80	Bone	S-22526	Quigg 1986
Cut Arm site	FhNa-86	Leve 8, upper	L	3387 +/- 50	Bone	BGS-238	Webster 2004
Cut Arm site	FhNa-86	Level 8, lower	L	3448 +/- 60	Bone	BGS-2384	Webster 2004
Dipper Gap	5LO101	Locality 1, Zone D, feature 16	D/H	3180 +/- 90	Charcoal	UGA-456	Gilmore et al. 1999; Metcalf 1974
Dipper Gap	5LO101	Locality 1, Zone D, feature 5	D/H	3410 +/- 90	Charcoal	UGA-453	Gilmore et al. 1999; Metcalf 1974
Dipper Gap	5LO101	Locality 1, Zone D, feature 10	D/H	3520 +/- 85	Charcoal	UGA-455	Gilmore et al. 1999; Metcalf 1974
Dog Child	FbNp-24	Level 2a	D/H/L	3460 +/- 45	Bone	BGS-2660	Pletz 2010
George Hey	39FA30	Feature 6	D/L	3520 +/- 70	Charcoal	WIS-1086	Tratebas 1998
George Hey	39FA30	Feature 9	D/L	3925 +/- 65	Charcoal	WIS-1065	Tratebas 1998
Graham II site	FaNq-30	burial	D/H/L	3245 +/- 50	Bone	S-1574	Walker 1984
Kinney Spring	5LR144	Site C, bank	L series	3250 +/- 80	Charcoal	Beta-6847	Gilmore et al. 1999; Morris et al. 1985
Kinney Spring	5LR144	Site C, L.87-97R.24F.9	L series	3800 +/- 70	Charcoal	Beta-7333	Gilmore et al. 1999; Morris et al. 1985
Kolterman	39FA68	Component B	L	3630 +/- 175	Charcoal	M-368	Wheeler 1995a
Kolterman	39FA68	Component B	L	4230 +/- 175	Charcoal	M-369	Wheeler 1995a

Site Name	Site #	Context	Associated Points	Date B.P.	Material	Lab No.	Source
Leigh Cave	48WA30	Single occupation	D/H	4170 +/- 150	Charcoal	Grey no. 25	Frison and Huseas 1968
Lightning Spring site	39HN20	Stratum 9	D	4190 +/- 110	Charcoal	TX-4083	Keyser and Davis 1999
Lightning Spring site	39HN20	Stratum 10	D	3850 +/- 150	Charcoal	TX-4081	Keyser and Davis 1999
Lightning Spring site	39HN20	Stratum 12	D	4040 +/- 90	Charcoal	Beta-58280	Keyser and Davis 1999
Lightning Spring site	39HN20	Stratum 14	D	4200 +/- 170	Charcoal	Beta-58279	Keyser and Davis 1999
LoDaisKa	5JF223	Complex C	D/L	3150 +/- 100	Charcoal	m-1006	Gilmore et al. 1999; Irwin and Irwin 1961
LoDaisKa	5JF223	Complex C	D/L	3400 +/- 100	Charcoal	m-1004	Gilmore et al. 1999; Irwin and Irwin 1961
Long Creek site	DgMr-1	level 5	H	3370 +/- 145	Charcoal	S-63a	Wettlaufer & Meyer-Oakes 1960
Long Creek site	DgMr-1	level 5	H	3375 +/- 55	Bone	BGS-2362	Webster 2004
Lunch Cave	5LR288	Feature 2	H	3085 +/- 60	Charcoal	UGA-1864	Gilmore et al. 1999
Malin Creek	24YE33	feature c	H	4580 +/- 50	Charcoal	Beta-174888	Davis et al 2012
Malin Creek	24YE33	feature e	H	5050 +/- 50	Charcoal	Beta-174889	Davis et al 2012
McKean	48CK7	Housepit hearth	D/H/L	3790 +/- 140	Charcoal	RL-1860	Kornfeld 1995; Kornfeld and Frison 1985
McKean	48CK7	Location 2, Block 1	D/H/L	4590 +/- 160	Charcoal	RL-1861	Kornfeld 1995; Kornfeld and Frison 1985
Medicine Lodge Creek	48BH499		D/H/L	3980 +/- 160	Charcoal	RL-96	Frison 1991:85
Medicine Lodge Creek	48BH499		D/H/L	4050 +/- 150	Charcoal	RL-438	Frison 1991:85
Mondrian Tree	32MZ58	area A - Zone 7	D	3550 +/- 85	Charcoal	UCR-1324	Toom 1983
Mondrian Tree	32MZ58	area A - Zone 7	D	3560 +/- 170	Charcoal	UCR-1326	Toom 1983
Mondrian Tree	32MZ58	area A - Zone 7	D	3580 +/- 170	Charcoal	UCR-1325	Toom 1983
Mondrian Tree	32MZ58	area A - Zone 7	D	3745 +/- 170	Charcoal	UCR-1323	Toom 1983
Mondrian Tree	32MZ58	area A - Zone 7	D	4030 +/- 100	Charcoal	UCR-1322	Toom 1983
Mortlach	EcNl-1		D	3400 +/- 200	Bone	S-2	Wettlaufer 1956
Mummy Cave	48PA20	Layer 30	D/L	4090 +/- 140	Charcoal	I-1580	Morlan n.d
Mummy Cave	48PA20	Layer 30	D/L	4170 +/- 130	Charcoal	I-1582	Morlan n.d
Mummy Cave	48PA20	Layer 30	D/L	4375 +/- 180	Charcoal	I-1034	Morlan n.d
Mummy Cave	48PA20	Layer 30	D/L	4420 +/- 150	Charcoal	I-1428	Wedel et al. 1968

Site Name	Site #	Context	Associated Points	Date B.P.	Material	Lab No.	Source
Pack Rat Rockshelter	5LR170	11S13W, Feature 51	D/H/L	2760 +/- 100	Charcoal	Beta-2286	Gilmore et al. 1999; Morris et al. 1986
Paint Rock V	48BH34	unknown	D/H/L	4310 +/- 140	Charcoal	RL-482	Frison 1991
Phoebe Rockshelter	5LR161	Level 3	D/H	3570 +/- 60	Charcoal	Beta-3869	Gilmore et al. 1999; Thompson 1986
Phoebe Rockshelter	5LR161	Level 3	D/H	3890 +/- 60	Charcoal	Beta-3870	Gilmore et al. 1999; Thompson 1986
Quinn Creek site	24JF110	XB:1	D/H	2830 +/- 90	Bone	Beta-11447	Rennie and Hughes 1998
Red Canyon Rockshelter	48CK1395	Component II	H/L	3260 +/- 80	Charcoal	Beta-3783	Tratebas 1998, on file WSHPO
Red Canyon Rockshelter	48CK1395	Component II	H/L	4440 +/- 60	Charcoal	Beta-81537	Tratebas 1998, on file WSHPO
Red Canyon Rockshelter	48CK1395	Component II	H/L	4550 +/- 130	Charcoal	Beta-73784	Tratebas 1998, on file WSHPO
Red Fox	32BO213	Level 4 east	D	3770 +/- 90	Charcoal	SI-479	Syms 1969
Red Tail site	FbNp-10	11	H	3580 +/- 80	Bone	S-3372	Ramsay 1993
Red Tail site	FbNp-10	12(1)	H	3470 +/- 80	Bone	S-3373	Ramsay 1993
Red Tail site	FbNp-10	12(2)	H	3660 +/- 75	Bone	S-3008	Ramsay 1993
Red Tail site	FbNp-10	13(2)	L	3860 +/- 70	Bone	S-3374	Ramsay 1993
Red Tail site	FbNp-10	13(2)	L	3880 +/- 70	Bone	S-3375	Ramsay 1993
Red Tail site	FbNp-10	13(4)	L	4280 +/- 80	Bone	S-3009	Ramsay 1993
Rigler Bluffs	24PA401	hearth feature	L	5040 +/- 150	Charcoal	Grey no 29	Haines 1962
Rock Creek site	5BL2712	feature 20	D	3120 +/- 190	Charcoal	Beta-71550	Gilmore et al. 1999; Gleichman et al. 1995
Rock Creek site	5BL2712	feature 22	D	3000 +/- 190	Charcoal	Beta-68172	Gilmore et al. 1999; Gleichman et al. 1995
Scoggin	48CR30	Single occupation	L/M	4540 +/- 110	Charcoal	L-3858	Lobdell 1974
Second Lake	EhPv-58	occupation 6	H	3560 +/- 135	Charcoal	S-2778	Fedje 1986
Second Lake	EhPv-58	occupation 6	H	2540 +/- 120	Bone	S-2754	Fedje 1986
Sjovold Site	EiNs-4	Layer XXI	H	3530 +/- 115	Bone	S-2062	Dyck and Morlan 1995
Southsider Cave	48BH364	n/a	L	3900 +/- 140	Charcoal	RL-668	Frison 1991
Southsider Cave	48BH364	n/a	L	4170 +/- 150	Charcoal	RL-672	Frison 1991
The Pas Reserve site	FbNp-5	Archaic component	D/H	3190 +/- 60	Charcoal	BGS-2369	Tamplin 1977
Thundercloud site	FbNp-25	5a	D/H/L	3150 +/- 50	Bone	BGS-2369	Webster 2004
Thundercloud site	FbNp-25	5b	D/H/L	3315 +/- 50	Bone	BGS-2367	Webster 2004
Thundercloud site	FbNp-25	5c	L	4040 +/- 90	Bone	BGS-3645	Webster 1999

Site Name	Site #	Context	Associated Points	Date B.P.	Material	Lab No.	Source
Thundercloud site	FbNp-25	5c	L	4040 +/- 90	Bone	BGS-3645	Webster 1999
Whitemouth Falls	EaLa-1	Level 2	L	3405 +/- 175	Bone	GX-4415	Buchner 1979
Whitemouth Falls	EaLa-1	Level 2	L	3405 +/- 175	Bone	GX-4415	Buchner 1979

Appendix C. Rejected Radiocarbon Ages

Site Name	Site #	Context	Associated Points	Date B.P. (Lab #)	Material	Lab No.	Source
	EaPk-201	West block, CU-2	H	3720 +/- 260	Bone	S-3984	Brumley 1975; Morlan n.d.
	EaPk-201	West block, CU-3	H	3860 +/- 320	Bone	S-3985	Brumley 1975; Morlan n.d.
	EgPn-430	Area 2	H/L, mixed	3580 +/- 70	Bone	BETA-126647	Vivian et al 2005
Benson's Butte	24BH1726	Middle Archaic Level	D/H/L/mixed	4230 +/- 50	Charcoal	TX-2797	Fredlund 1979
Bradford House II	5JF51	Hearth	D	3255 +/- 765	Charcoal	UGA-4000	Gilmore et al. 1999; Johnson et al. 1997; Richardson 1974;
Cherry Point	DkMe-10	Occupation B	D/H/mixed	1850 +/- 100	Bone	S-1031	Balcom 1976, Haug 1975
Cherry Point	DkMe-10	Occupation B	D/H/mixed	2060 +/- 130	Bone	S-1032	Balcom 1976, Haug 1975
Cherry Point	DkMe-10	Occupation C	D/H/mixed	2830 +/- 260	Bone	S-1030	Balcom 1976, Haug 1975
Cherry Point	DkMe-10	Occupation C	D/H/mixed	2860 +/- 210	Bone	S-1029	Balcom 1976, Haug 1975
Dead Indian Creek	48PA55	Area 1	D/L/mixed	3800 +/- 110	Charcoal	RL-321	Wilson 1984
Dead Indian Creek	48PA55	Area 1	D/L/mixed	4180 +/- 250	Charcoal	W-2597	Wilson 1984
Dead Indian Creek	48PA55	Area 1	D/L/mixed	4430 +/- 250	Charcoal	W-2599	Wilson 1984
Falcon's Nest	5JF211	67-70 BGS	D/H/L/M/ mixed	2760 +/- 110	Charcoal	Beta-17605	Adkins 1993; Gilmore et al. 1999
Gant Site	39ME9	Unit III	D/H/L/mixed	4130 +/- 130	Charcoal	n/a	Keyser and Davis 1999
Lightning Spring site	39HN20	Stratum 8	D	3430 +/- 270	Charcoal	TX-4084	Keyser and Davis 1999
Lightning Spring site	39HN20	Stratum 10	D	3870 +/- 210	Charcoal	TX-4082	Keyser and Davis 1999
Meyers-Hindman	24PA504	Settlement Unit 4	D/H/L/mixed	3150 +/- 110	Bone	Gak2630	Lahren 1976
Meyers-Hindman	24PA504	Settlement Unit 4	D/H/L/mixed	3530 +/- 110	Charcoal	Gak2629	Lahren 1976
Natrona Housepit site	48NA2526	Middle Feature 4	D/H/L/mixed	3820 +/- 50	Charcoal	NA2526-4	McClelland and Martin 1999
Natrona Housepit site	48NA2526	Top Feature 4	D/H/L/mixed	3870 +/- 50	Charcoal	NA2526-3	McClelland and Martin 1999
Natrona Housepit site	48NA2526	Bottom Feature 4	D//H/Lmixed	3870 +/- 50	Charcoal	NA2526-5	McClelland and Martin 1999
Natrona Housepit site	48NA2526	Feature 4.3	D/H/L/mixed	3910 +/- 50	Charcoal	NA2526-7	McClelland and Martin 1999
Natrona Housepit site	48NA2526	Feature 4.2	D/H/L/mixed	3920 +/- 50	Charcoal	NA2526-6	McClelland and Martin 1999
Natrona Housepit site	48NA2526	Bottom Feature 4	D/H/L/mixed	4080 +/- 70	Charcoal	S-5-15-2	McClelland and Martin 1999
Natrona Housepit site	48NA2526	Feature 9	D/H/L/mixed	4840 +/- 50	Charcoal	NA2526-8	McClelland and Martin 1999

Site Name	Site #	Context	Associated Points	Date B.P.	Material	Lab No.	Source
Pack Rat Rockshelter	5LR170	11S13W, Feature 57	D/H/L	2480 +/- 90 (rejected)	Charcoal	Beta-2288	Gilmore et al. 1999; Morris et al. 1986
Pass Creek Cabin	DgPl-1	Occupation 1C	L, mixed	3860 +/- 215	Apatite	GX-1460	Brumley 1975; Morlan n.d.
Rigler Bluffs	24PA401	Hearth feature	L	4900 +/- 300	Charcoal	W-1135	Haines 1962
Signal Butte	25SF1	IC	H/L	4170 +/- 250	Charcoal	L-385D	Forbis 1985
Signal Butte	25SF1	1A	H/L	4550 +/- 220	Charcoal	L-385B	Forbis 1985
Sorenson	24CB202	Occupation V	D/mixed	4900 +/- 250	Charcoal	I-691	Ruebelmann 1982
Swallow site	5JF321	Feature 17	D/L,mixed	3440 +/- 90	Charcoal	Beta-44398	Gilmore et al. 1999; Rathbun 1991
Swallow site	5JF321	Feature 107	D/L/mixed	3150 +/- 100	Charcoal	Beta-42288	Gilmore et al. 1999; Rathbun 1991